PUBLIC WORKS

City, County and State

October, 1961

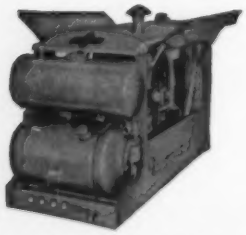
Thomas R. Glenn, Jr., is Director and Chief Engineer of the Interstate Sanitation Commission, a Tri-State agency of New York, New Jersey and Connecticut. He is shown here aboard a survey boat engaged in sampling waters of the Upper New York Bay, with the Statue of Liberty in the background. See page 18 for more data.

125-cfm Gyro-Flo on a paint spray truck for highway lining.

Why compressed-air costs toe-the-line when you

DEPEND ON GYRO-FLO

125-cfm Gyro-Flo compressor arranged for truck mounting.



85-cfm Gyro-Flo unit in compact truck-mounting design.

Both operating costs and maintenance costs are low and stay low with Gyro-Flo... whether you use the compact power-take-off, truck-mounted or wheeled units.

Time-tested Gyro-Flo rotary compressor design assures sustained high fuel and lube oil economy, year after year. And time-tested Gyro-Flo construction is your guarantee of rock-bottom maintenance costs.

Available in 85 to 900 cfm sizes, Gyro-Flo compressors provide smooth, dependable 100-psi air power for every type of construction and maintenance work. Whatever the job, you can *depend* on Gyro-Flo.

The World's Most Comprehensive Compressor Experience

Ingersoll-Rand
291A2 11 Broadway, New York 4, N. Y.

GYRO-FLO.

"from Chicago"

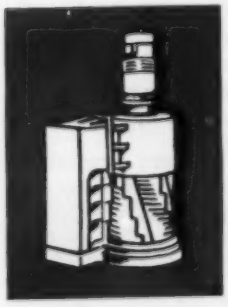
LOWER COST COMMINUTION FOR RECTANGULAR CHANNELS...

THE MODEL "C" BARMINUTOR WITH THESE NEW FEATURES

- Automatic safety slip-clutch
- Counter-weighted to minimize friction . . . increasing life of machine
- Stainless Steel Screen
- Ball Bearing Shoes
- Single Motor Drive . . . lower operating horsepower required
- Reversible cutting to provide increased cutting capacity and extended cutter life
- Rugged, economical design and construction

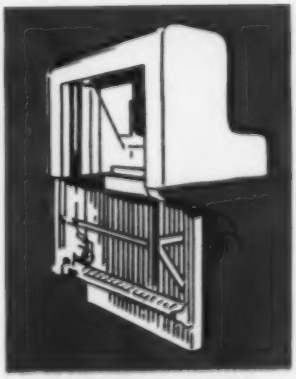
Provides continuous, complete, automatic screening and comminution without removal from flow. Is operated and maintained at lower cost than any similar device. Eliminates unsightliness, nuisance and odor. Requires less power.

OTHER "CHICAGO" COMMINUTING MACHINES



THE ORIGINAL COMMINUTOR

The original Comminutor, developed by Chicago Pump provides continuous screening and cutting of coarse sewage matter for use in hydraulically designed feeder basins. Sized for flows of .175 to 25 MGD per machine.



MODEL "A" BARMINUTOR

All electric drive reversible screening and comminuting machine for handling high flows in rectangular channels four to eight feet wide. Shear bars produce extra cutting capacity without corresponding increase in power requirement. Neat, compact drive motor and panel.

fmc CORPORATION

HYDRODYNAMICS DIVISION

CHICAGO PUMP

622F Diversey Parkway • Chicago 14, Illinois

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10 FEET'S ENOUGH

for Cat Loaders with Side Dump Buckets to cut loading cost and time

• **SNOW REMOVAL** under traffic—Cat 944 with Side Dump Bucket needs only 10 feet to scoop and dump into an adjacent truck. And the outside lane is open to traffic. The City of Fulton, N. Y., finds snow removal just one of the tight-spot jobs made easy by its 944 with Side Dump.

And this Caterpillar exclusive, which dumps forward as well as left, is only part of the story: Fulton Public Works officials like the way the 944 works safely in traffic; they notice the fast loading cycles due to the automatic bucket controls that lift and hold the loaded bucket, reset to the correct digging angle—all while the operator is maneuvering the loader; and they're pleased with the fast power shift that boosts operator efficiency, saves time.

• **DIGGING OUT** a tough, frost-buckled road, this Cat 977 excavates and loads from one lane—working here for Hennepin County, Minn. There's no time-wasting jockeying and turning, or tearing up yards and ditches.

• **CUT COSTS 38%.** In a recent comparison test a 977H was equipped with a side dump and then a conventional bucket. Loading bank run sand and gravel, the side dump bucket reduced handling cost 38% and cycle time 35%. That kind of efficiency pays for itself quickly. It's one of the reasons Caterpillar equipment sets the standard for low, long-term cost. Ask your Cat Dealer to demonstrate these cost-cutting advantages to you.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

OCTOBER, 1961 • Volume 92, Number 10

County Master Plan for Water Supply and Sewerage 101
The County Planning Commission of Bucks County, Pa., has prepared for surburban development with a master plan for water and sewerage facilities. This article describes the methods employed.
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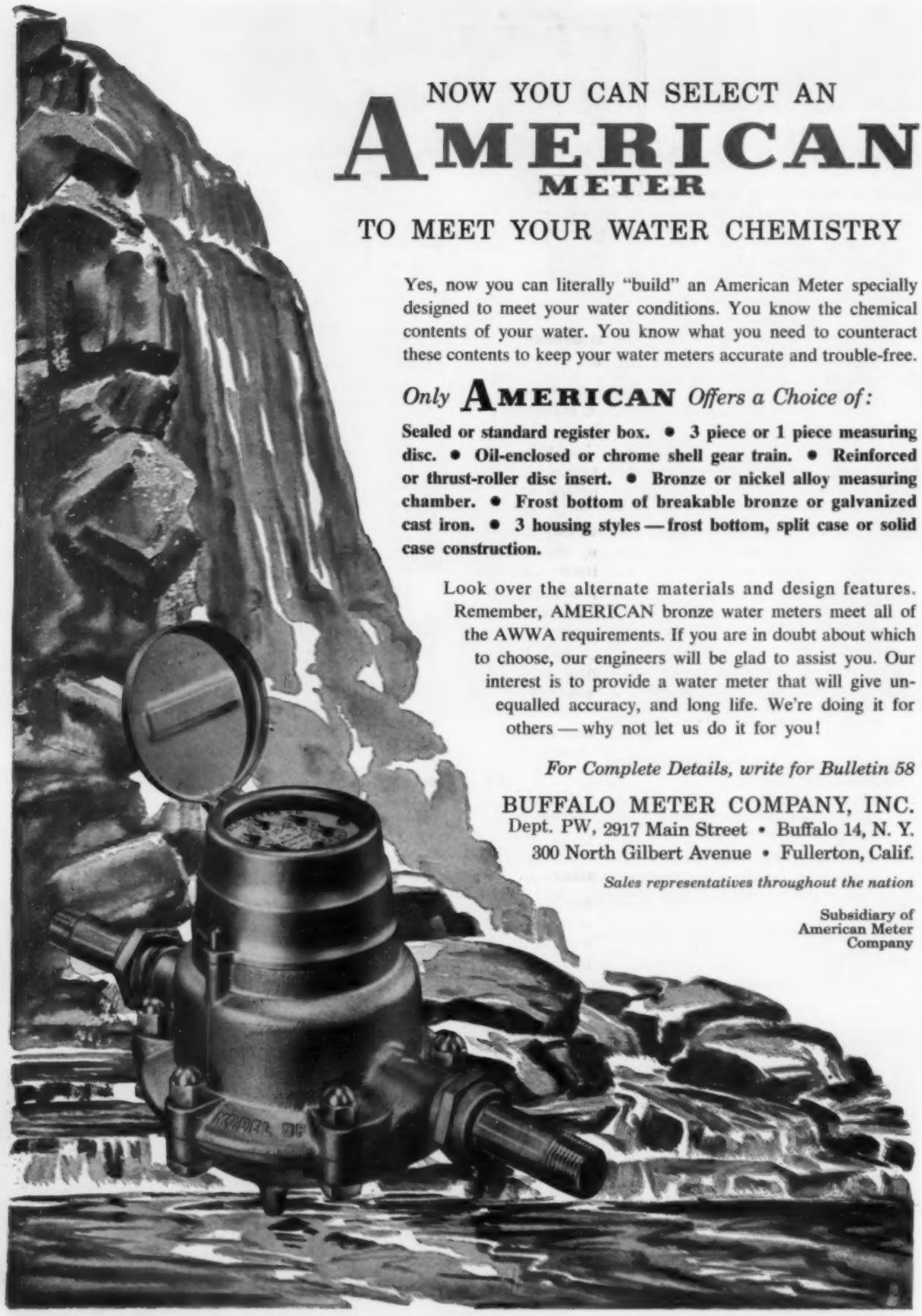
BPA

PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.



NOW YOU CAN SELECT AN

AMERICAN METER

TO MEET YOUR WATER CHEMISTRY

Yes, now you can literally "build" an American Meter specially designed to meet your water conditions. You know the chemical contents of your water. You know what you need to counteract these contents to keep your water meters accurate and trouble-free.

Only AMERICAN *Offers a Choice of:*

Sealed or standard register box. • 3 piece or 1 piece measuring disc. • Oil-enclosed or chrome shell gear train. • Reinforced or thrust-roller disc insert. • Bronze or nickel alloy measuring chamber. • Frost bottom of breakable bronze or galvanized cast iron. • 3 housing styles — frost bottom, split case or solid case construction.

Look over the alternate materials and design features. Remember, AMERICAN bronze water meters meet all of the AWWA requirements. If you are in doubt about which to choose, our engineers will be glad to assist you. Our interest is to provide a water meter that will give unequalled accuracy, and long life. We're doing it for others — why not let us do it for you!

For Complete Details, write for Bulletin 58

BUFFALO METER COMPANY, INC.
Dept. PW, 2917 Main Street • Buffalo 14, N. Y.
300 North Gilbert Avenue • Fullerton, Calif.

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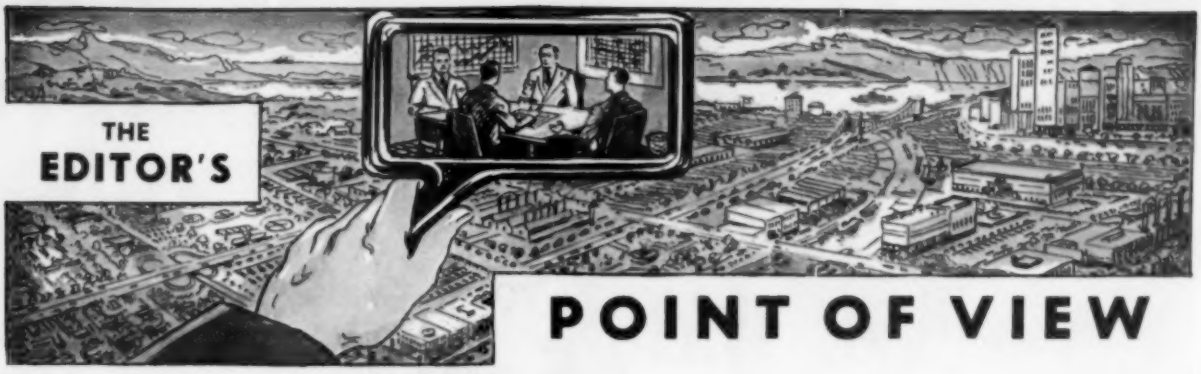
Subsidiary of
American Meter
Company



The Importance of Highway Maintenance Is Not Always Recognized

MOST ENGINEERS know that maintenance should begin the day construction is completed; but too many of them look at the shining ribbons of the new interstate highway, with its latest design features, and fail to see that maintenance is an immediate necessity. It is true that surface maintenance may be more serious a little later; but it will come under the pounding of present day heavy vehicles. In the meantime, drainage, shoulders, structures, roadsides and many other items require constant skilled attention if the heavy original investment is to be protected. Engineers, however, are not the only ones with a blind spot toward maintenance; equipment manufacturers, by and large, have been slow in developing cost-saving tools for maintenance and too often have concentrated on selling the tools they have to the construction field. Maintenance is a multi-billion dollar business, counting Interstate, Federal, state and county highway systems and city streets; it is also an essential if we are to protect the many other billions already invested in our highway system and, at the same time, keep traffic moving.

A Sod Buster and Gulley Washer

A LATE August storm is reported to have dumped 1.6 inches of rain in 10 minutes on sections of Nassau County, Long Island, N. Y. If the preliminary figures are correct, the rainfall was more intense than the New York City absolute maximum and in one of the standard rainfall formulas is represented by $i = 384/t + 30$. In local parlance, this rainfall qualifies fully under the heading at the top of this paragraph. The storm was of short duration and therefore small damage resulted.

Leakage from Underground Gasoline and Chemical Storage Tanks

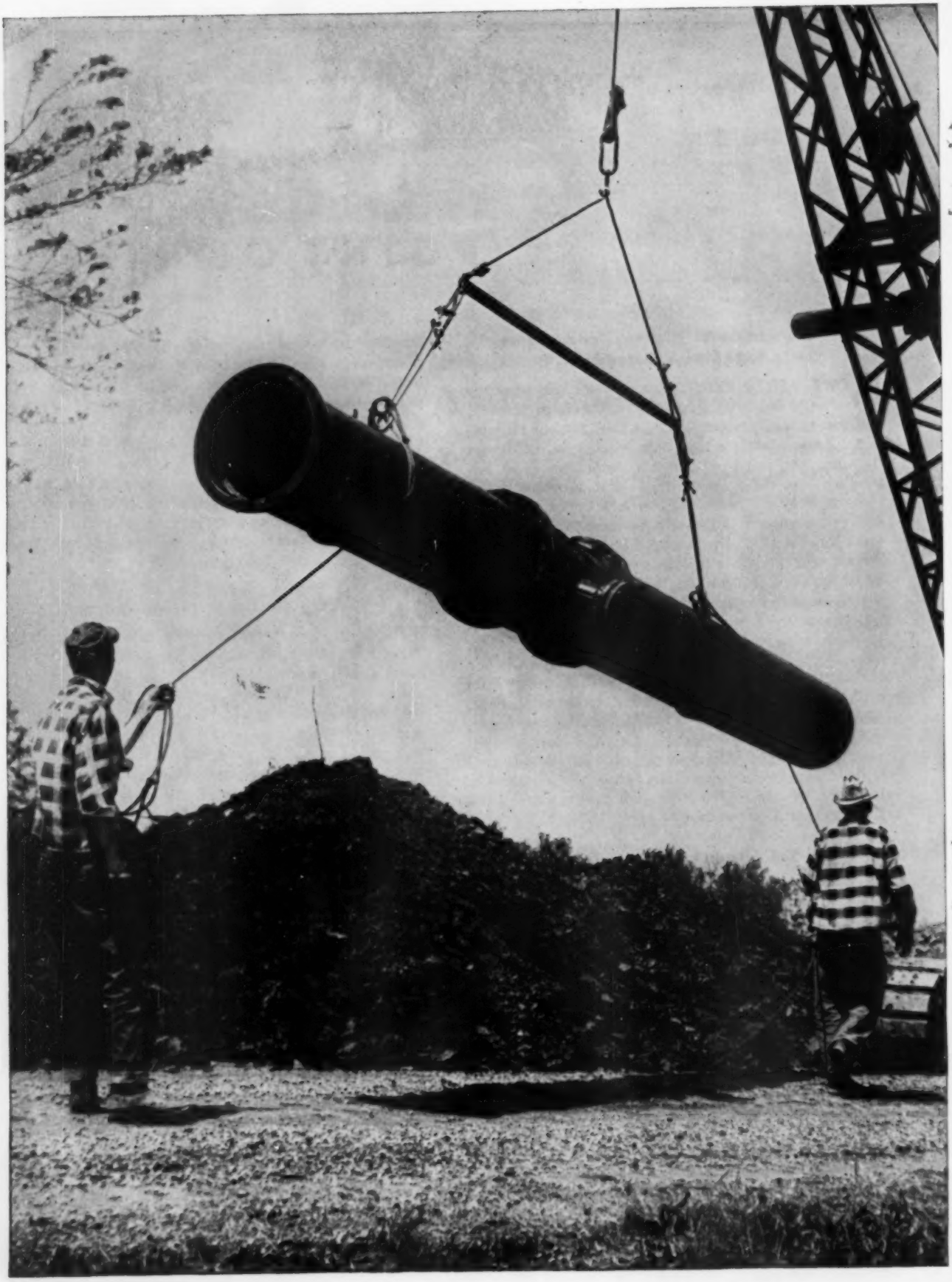
SEVERAL INSTANCES have been reported recently where trenches or foundation excavations have penetrated subsurface areas saturated with gasoline or with chemical compounds. Considering the number of gasoline tanks in use, many of them in service for a period of years, a real hazard may exist due to leakage from them. We know of no procedure for checking or testing such tanks on a regular basis for leaks or other defects but it seems that consideration should be given to the problem. Not only is subsurface water quality impaired but a fire and injury risk exists. Any program for inspection of gasoline storage tanks should, of course, be discussed with oil companies owning and maintaining such storage tanks but complete reliance should not be placed on their records or on their procedures. The same applies to underground chemical tanks. In both cases, the community has a responsibility.

The Challenge to Improve

THE MAJOR construction program on Interstate, ABC and Secondary roads has generated concurrent improvement by industry in materials and equipment. Still lacking in many public works departments is an appreciation of the need for full and effective utilization of these modern materials, equipment and practices. The emphasis on high maintenance standards as established by the toll roads and the Interstate system; the new and diversified facilities and services that must be provided for the Interstate highway user; the complexities of urban expressway and arterial systems; and the growth and change in traffic patterns on city streets and county roads influenced by the new highways, all combine to present the greatest challenge ever faced by public works agencies. Meeting this challenge successfully involves improved management, training, planning, equipment procurement and work procedures.

Looking North

AT THIS time of the year most folks are concerned with keeping cool and it is too easy to forget those king-sized snowstorms that belabored the northeast last winter. Snow removal equipment took a terrible beating and, we suspect, the men in charge did too; but men have a recuperative power that equipment lacks. We trust there will be no recurrence of the big snows of the past winter; but we hope, just in case, that our cities, counties and states will have ready for immediate use enough new plows, trucks and spreaders to meet any and all conditions of weather.



PIPE THAT SHOULDERS A HEAVY LOAD WITHOUT SHOWING ITS AGE

Recently installed in a town in Illinois, this cast iron pipe water supply system now serves a large industrial area.

Besides the internal pressure of supplying the heavy daily demand, there is a heavy load overhead, too. The industrial area is a packaging and distribution center. Large numbers of fully loaded rail cars and trucks come and go every day.

As far as the cast iron pipe is concerned, this is all in a day's work.

Cast iron pipe shoulders heavy loads—interior and exterior—year after year; performs efficiently for a century or more.

And it always delivers a full flow of water.

Advertising campaign from Cast Iron Pipe Research Association shoulders a heavy load, too!

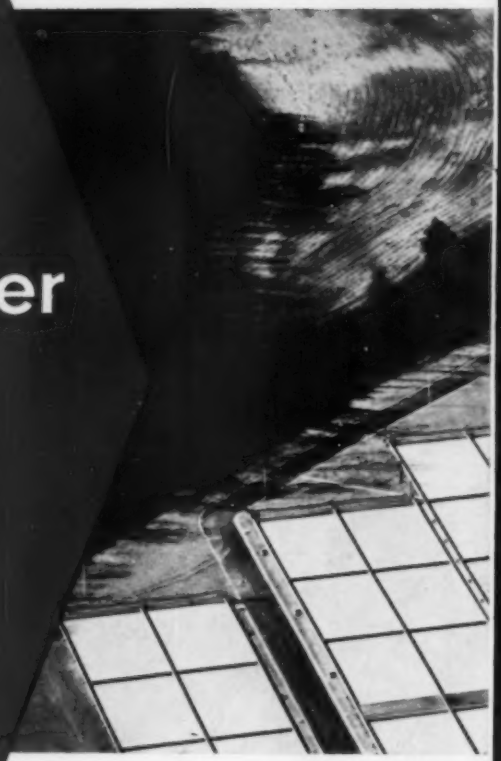
For years the Cast Iron Pipe Research Association has attacked the water problem nationally; now, in addition, it is undertaking a new campaign to combat this crisis on a local level. Car cards, speeches, radio spots, newspaper ads, mailing pieces—everything will be included. If your town's problem is apathy or a growing water shortage, we may be able to help. For complete details, write to the Cast Iron Pipe Research Association today!

CAST IRON PIPE RESEARCH ASSOCIATION,
Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

CAST IRON PIPE
THE MARK OF THE 100-YEAR PIPE

Everybody talks about ending water pollution . . .

The Trickling Filter Floor Institute does something about it!



The Institute is an organization of seven leading manufacturers of trickling filter floor blocks dedicated to furthering research, development and improvement of vitrified clay underdrains for Trickling Filters. It is making an important contribution to the country's Clean Waters program.

Engineers studying the different types of treatment for industrial wastes and domestic sewage can find help in the results of this research and development available from any of the members. This help includes—if you do not already have a copy—the TFFI Handbook containing valuable design and operational data and the latest ASTM Specifications C 159-59T.

WHY TRICKLING FILTERS?

That more trickling filters have been built in the past fifteen years than all other types of treatment plants is no accident. Sound reasons for this trend lie in the fact that the trickling filter combines durability with flexibility, low initial cost with low operating cost. In addition, those filters built thirty and more years ago are serving well today. With them, too, you can guard against the continuous or unforeseen major remodelings common to some other types. Trickling filters are easily added to when community or industry growth demand expansion.

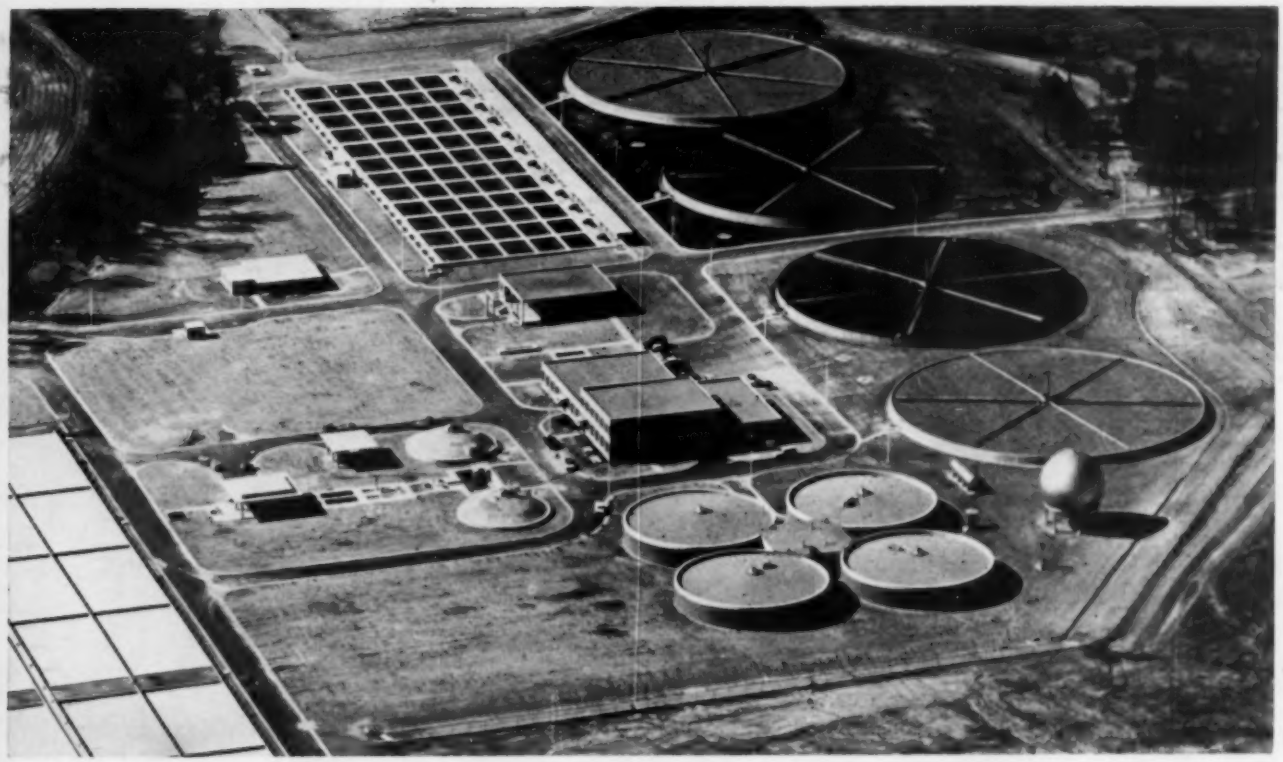
Many of these advantages are based on their employment of enduring vitrified clay floor blocks in the underdrains.

WITH VITRIFIED CLAY UNDERDRAINS

TFFI Specification vitrified clay underdrain blocks are the best assurance against future trouble in a location where trouble can be *big* trouble. (Tearing out a "substitute" filter floor that has failed is no fun and less economy). Then any "savings" gained by use of substitute materials are more than lost. Experience has shown conclusively that vitrified clay is the *one* material with the longest record of freedom from failure under the corrosive effects of acids, alkalis and bacteriological action.

This alone argues against any experiments with failure-prone substitutes at merely a lower first cost. This is why the TFFI blocks are now going into 90% of the filter floors compared with 15% some thirteen years ago.

This modern sewage treatment plant at Winston-Salem, N. C., has TFFI specification vitrified clay floor blocks in its four 200-foot Trickling Filters. Consulting Engineers, Piatt & Davis, Durham, N. C. General Contractor, Lee Construction Co., Charlotte, N. C. Photo, courtesy of A. M. Byers Co., Pittsburgh.



FIRST COST OR TRUE COST?

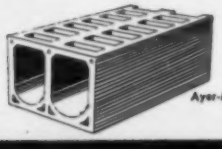
The only true cost is the final one. Clay outlasts all other materials in filter floors so it **under**-costs them in **the long run.** This time-tested proven fact outweighs any temporary savings which might follow resort to use of less durable materials for the underdrains.

50-YEAR GUARANTEE

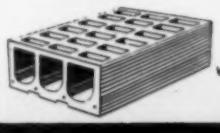
Because their vitrified clay floor blocks are made in modern plants under manufacturing controls of quality impossible with substitute materials, TFFI members offer a 50-Year Guarantee of their blocks.

Demand CERTIFIED Underdrain Blocks

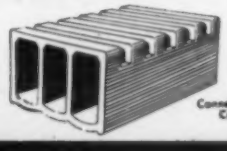
Vitrified clay block manufactured by TFFI members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. For a copy of these Specifications, see your TFFI Handbook or write nearest member for one.



ARMCRE
Ayer-McCord Clay Co., Inc.
Brazil, Ind.

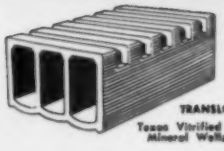


DICKEY
W. S. Dickey Clay Mfg. Co.
P.O. Box 2038
Kansas City 42, Mo.

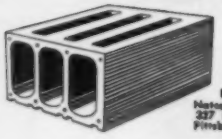


TRANSLOT
Connelton Sewer Pipe Co
Connelton, Indiana

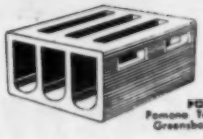
Trickling Filter Floor Institute



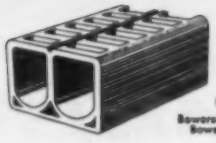
TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



NATCO
Natco Corporation
227 Fifth Avenue
Pittsburgh 22, Pa.



POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

BIG PERFORMANCE... LOW MAINTENANCE WITH PINNED-DOWN STABILITY

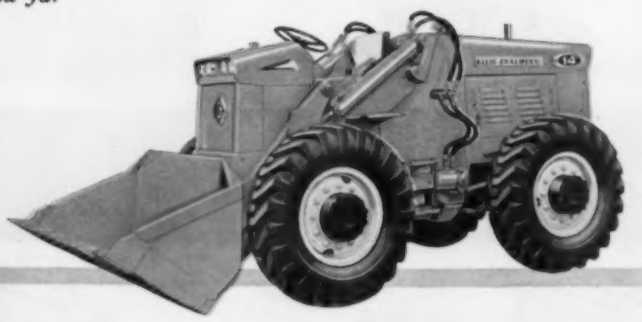
Allis-Chalmers tractor loaders feature axles that are pin-connected to the frame with thick steel pins . . . not automotive-type U-bolt connections. Tractor loaders stay on the job . . . not in the shop.

Pinned-down stability—that's what you get in Allis-Chalmers tractor loaders. Axles on these units are pin-connected to the frame with thick steel pins . . . not lightweight U-bolt connections. There's no rolling or shifting under load . . . no grief with bolts working loose . . . or mounting plates warping out of shape.

Pin-connected axles keep Allis-Chalmers loaders on the job . . . not in the shop. There's far less downtime due to annoying axle problems. You'll also profit from: *extra stability* from a longer wheelbase to length ratio; *single-lever control* of all speed and direction movements; *five-way hydraulic filtering* for safe, efficient operation; *well-located dump cylinders* that are up and away from dirt and *high lift—long reach* for fast, easy loading cycles.

See Allis-Chalmers loaders in action. Be convinced that these units can bring you extra earnings on all excavating and loading work. *Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.*

Allis-Chalmers offers 6 tractor loader models—ranging in power from 76.5 to 184 horsepower—in carry capacity from 3,600 to 10,500 lb and with buckets available from 1 to 6 cu yd.



STEP UP YOUR

Performance
Operator comfort
Wearability
Ease of maintenance
Reliability

WITH **ALLIS-CHALMERS**
POWER FOR A GROWING WORLD

How to cut highway grass

maintenance costs in half

Proved chemical growth retardant MH-30 practically eliminates mowing!

It is estimated that mowing grass areas along state and local highways costs a staggering $50,000,000 a year! And as more highways with larger grass areas are being built, state authorities find these costs constantly rising and are forced to divert an ever-increasing share of their budgets to grass control.

However, this trend can be and is being halted. MH-30, the highly effective chemical mower, has been used successfully for a number of years in England and by several of our States. In Connecticut, for example, MH-30 used on slope areas demonstrated a 50% saving... up to $35 per acre.

MH-30 can:

- greatly reduce grass maintenance costs
- significantly expand the power of your budget dollar
- free highway maintenance men for other vital tasks
- minimize hazards to traffic and maintenance crews

When sprayed on healthy grass, MH-30 is absorbed through the leaves, moves to the plant-growth center. Here it halts upward growth, practically eliminates the need for mowing, frequently promotes lateral growth for a thicker, lusher sod.

In addition, MH-30 provides two-way safety. No more toxic than table salt, its use will not endanger humans, animals or birdlife. It is non-irritating, presents no handling or drift problems. And, by cutting grass mowing to a minimum, MH-30 reduces the chances of injury to crews working on today's busy highways.

Look into MH-30. Get further information about this superior *chemical mower* now. See your Naugatuck representative or write: Dept. A, Elm Street, Naugatuck, Conn.

Watch For This Demonstration Truck...

It's one of a fleet of trucks that will be traveling the country, demonstrating the safety and ease of application, the economy and effectiveness of *chemical mowing* with MH-30. It also illustrates the ease of conversion of your equipment to this advanced grass control system.

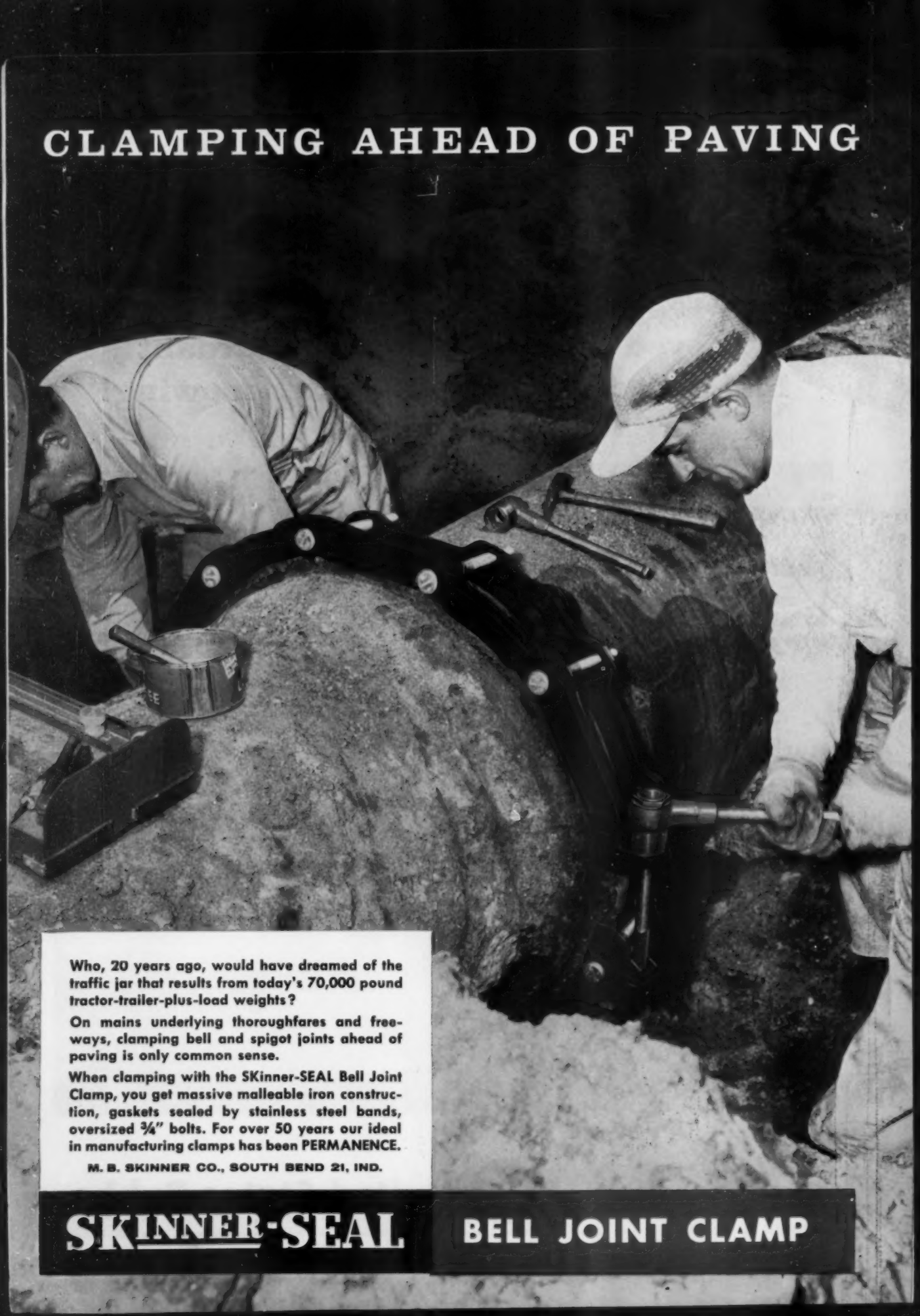
This truck, operated by just two men... demonstrates five proven and effective ways of applying MH-30. Here we see the air-blast spraying method featuring a converted row-crop sprayer mounted on the truck's rear. This method gives effective coverage 70-80 feet from the highway shoulder. Other methods designed to cope with every conceivable contour, median, and obstacle condition have been engineered and will be demonstrated. *All equipment demonstrated is commercially available.*

Look for this truck in your area and be sure to ask your Naugatuck district officer or contact address below for a viewing of the new film, "*Chemical Mowing*," for documented proof of the economy, effectiveness, and safety of using MH-30 for grass control.

Naugatuck Chemical Division **United States Rubber**

DISTRICT OFFICES: Akron · Boston · Portland · San Francisco · Chicago · Detroit · Gastonia · Los Angeles · Memphis · New Brunswick, N. J. · Latex Division, Dominion Rubber Company, Ltd., Montreal · CABLE: Rubexport, N.Y.

CLAMPING AHEAD OF PAVING



Who, 20 years ago, would have dreamed of the traffic jar that results from today's 70,000 pound tractor-trailer-plus-load weights?

On mains underlying thoroughfares and freeways, clamping bell and spigot joints ahead of paving is only common sense.

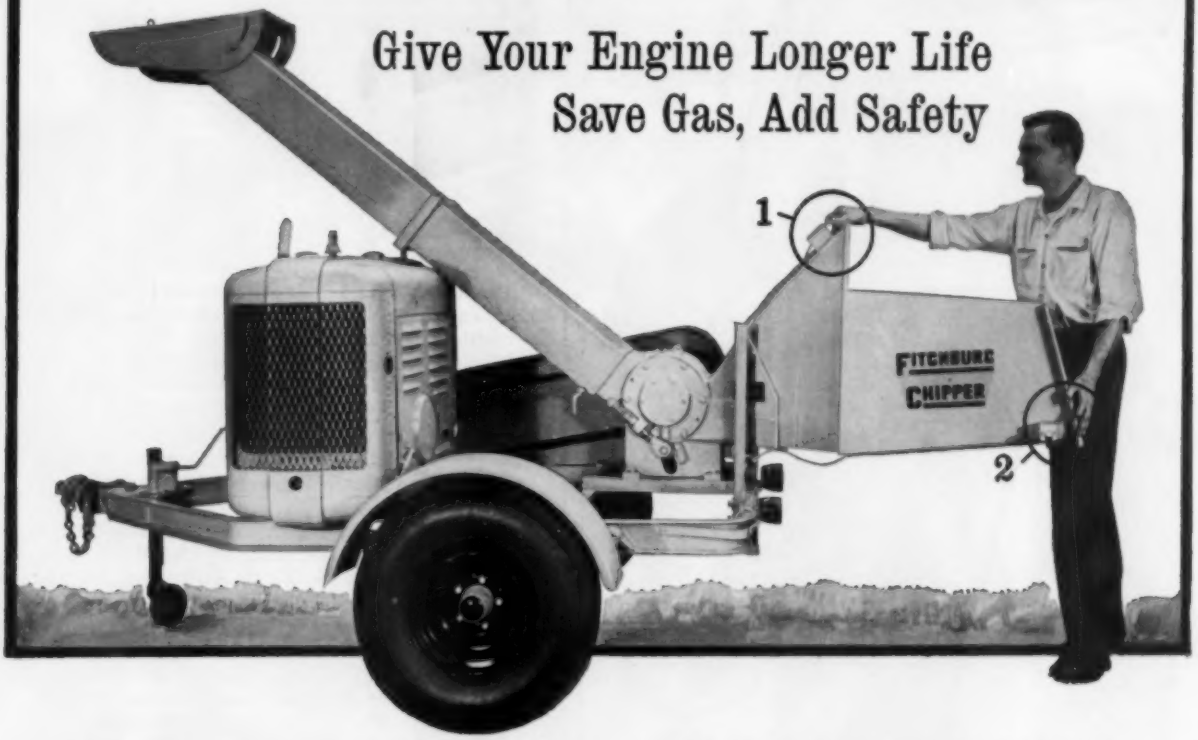
When clamping with the SKinner-SEAL Bell Joint Clamp, you get massive malleable iron construction, gaskets sealed by stainless steel bands, oversized ¾" bolts. For over 50 years our ideal in manufacturing clamps has been PERMANENCE.

M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL BELL JOINT CLAMP

2 NEW FITCHBURG CHIPPER FEATURES

Give Your Engine Longer Life
Save Gas, Add Safety



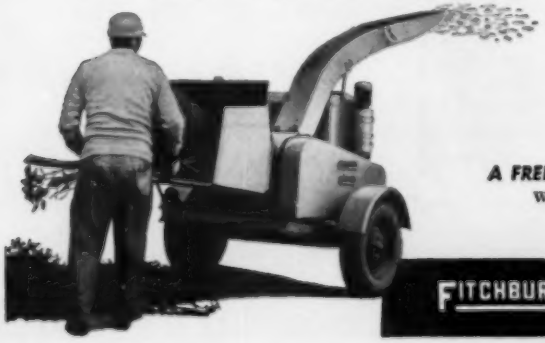
1 **EXTRA PROTECTION** for your crews with this NEW SAFETY STOP SWITCH that stops all moving parts of the chipper within seconds. Switch is within easy reach at rear so operator can flip it without moving from feed position. An important new feature of the Fitchburg Chipper, *already considered safest* because it has no hard-to-control flywheel.

2 **GREATER ECONOMY** with this NEW SOLENOID SWITCH* which allows the operator to quickly idle the motor between actual brush feedings. With the motor idling, you save on gasoline and engine wear; and there's less noise, which pleases the public. Your operator can use the switch easily because it is at the rear and handy.

CHIPPING IS SMOOTHER and faster with a Fitchburg because of its exclusive *spring activated feed plate.* This patented feed plate "gives" *automatically* under pressure. You can chip even large limbs (up to rated capacity) without killing the engine. And your crews are safer because the feeding action is more positive, smoother, with less whipping of the brush.

CHIPPING IS MORE EFFICIENT with a Fitchburg. The exclusive feed plate allows wood to be chewed up in small bites. This takes less power, and the engine can be run at lower r.p.m.—which is more efficient, saves you gas and cuts engine wear.

TROUBLE-FREE Fitchburg Chippers stay out of your shop so you don't lose valuable man-hours. These rugged machines are the choice of tree surgeons, line clearance contractors and others—men who depend on Chippers day after day to make money. Blades are made from special alloy steel to hold a keen edge for a long time, even with hard use. Fitchburg Chippers are well-engineered, come in four sizes to meet your needs: the largest handle limbs as thick as seven inches with ease.



A FREE BOOK "Chip Dollars" should be in your hands if you deal with brush disposal. 20-pages. Write for free copy — Dept. PW-110.

*optional equipment

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

At Your Supply House!
The Ridge Tool Company, Elyria, Ohio, U. S. A.

About Our Cover

Thomas R. Glenn, Jr., is Director and Chief Engineer of the Interstate Sanitation Commission, a position he has held since 1956. The Commission was formed by a compact between New York, New Jersey and Connecticut to accomplish the abatement of existing and control of future pollution in the New York Metropolitan Area. The District waters include 1500 miles of shore line with more than 130 sewage treatment plants serving 11 million people.

Mr. G.enn has a BS in Chemical Engineering from the University of Texas and an MS in Sanitary Science from N. Y. U. Following wartime service in the Navy, he taught graduate and undergraduate courses in sanitary engineering at Rutgers for ten years; also refresher courses for water and sewage plant operators; and refresher courses for professional engineer licenses. In addition he acted as consultant in the design of water and sewage treatment plants, dams, reservoirs and water and sewerage systems. He is a registered professional engineer and holds membership in ASCE, AASE, AWWA and WPCF. Currently he is executive secretary of the ASEIB.

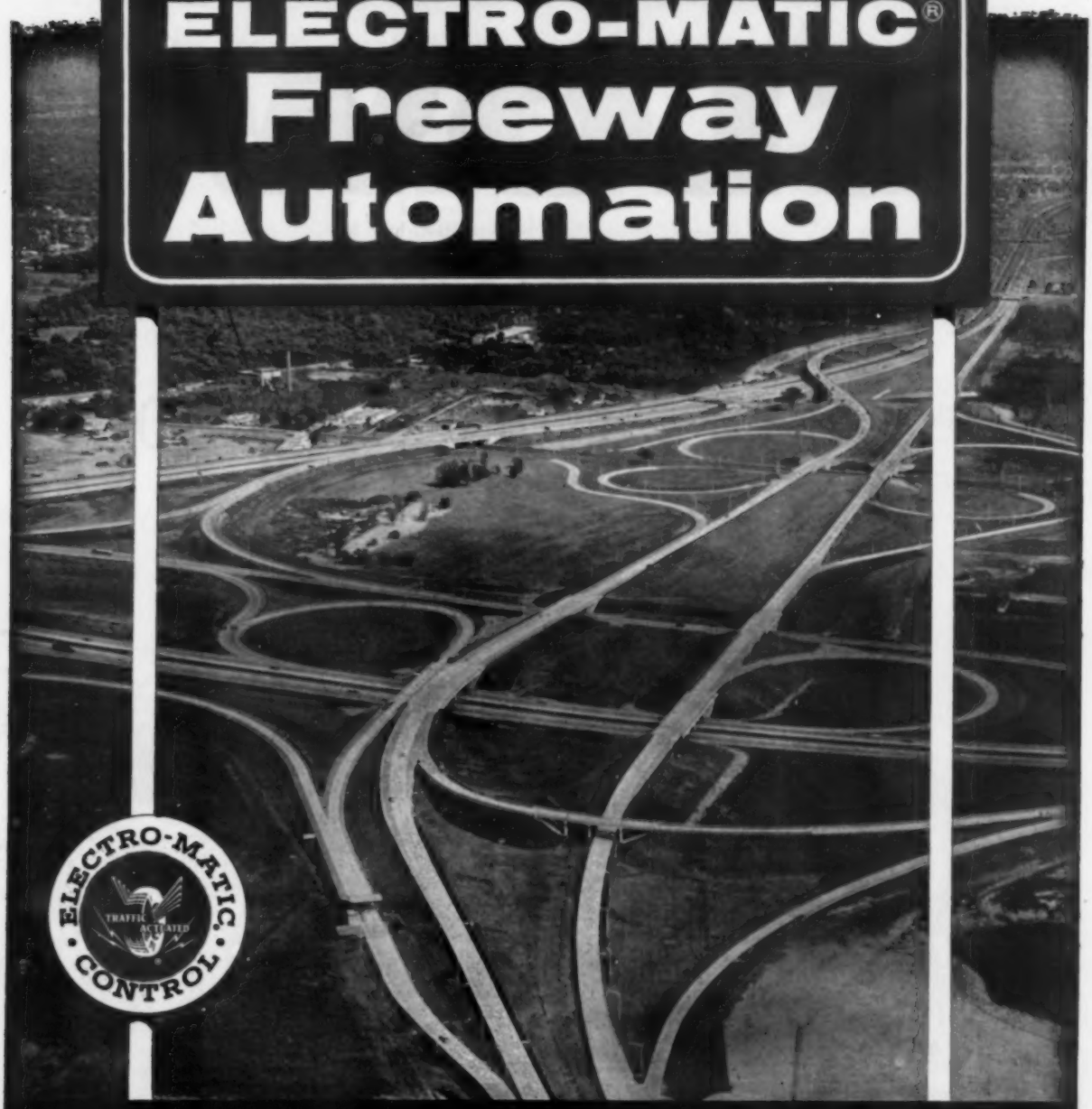
He and Mrs. Glenn have three children; his neglected hobby is sports, especially tennis and golf. The neglect arises largely from his work which includes programs of plant sampling, water area surveys and study of other specific area problems.

As a part of the activities of the Interstate Sanitation Commission, several water area evaluation surveys have been conducted to provide data on basic patterns of water quality. The picture on the cover of this issue was made aboard a boat used by the ISC for one of these intensive sampling programs.

Sampling activities are carried on during a four to five-week period so that data will be provided during all quadrants of the tidal cycle. Each sampling station is visited three to four times daily, four days a week by a chartered boat which is temporarily converted to a floating laboratory. A two-man crew takes samples and makes determinations of temperature and dissolved oxygen content. Other samples for BOD and salinity determinations are brought in for testing at the headquarters laboratory. Where recreational waters are involved, sample tubes are inoculated in the field for additional determinations of coliform density. Other details of the water survey work of the ISC will be found in the article by Mr. Glenn on page 121.

Get Maximum Production • Service • Safety on Freeways with

ELECTRO-MATIC® Freeway Automation



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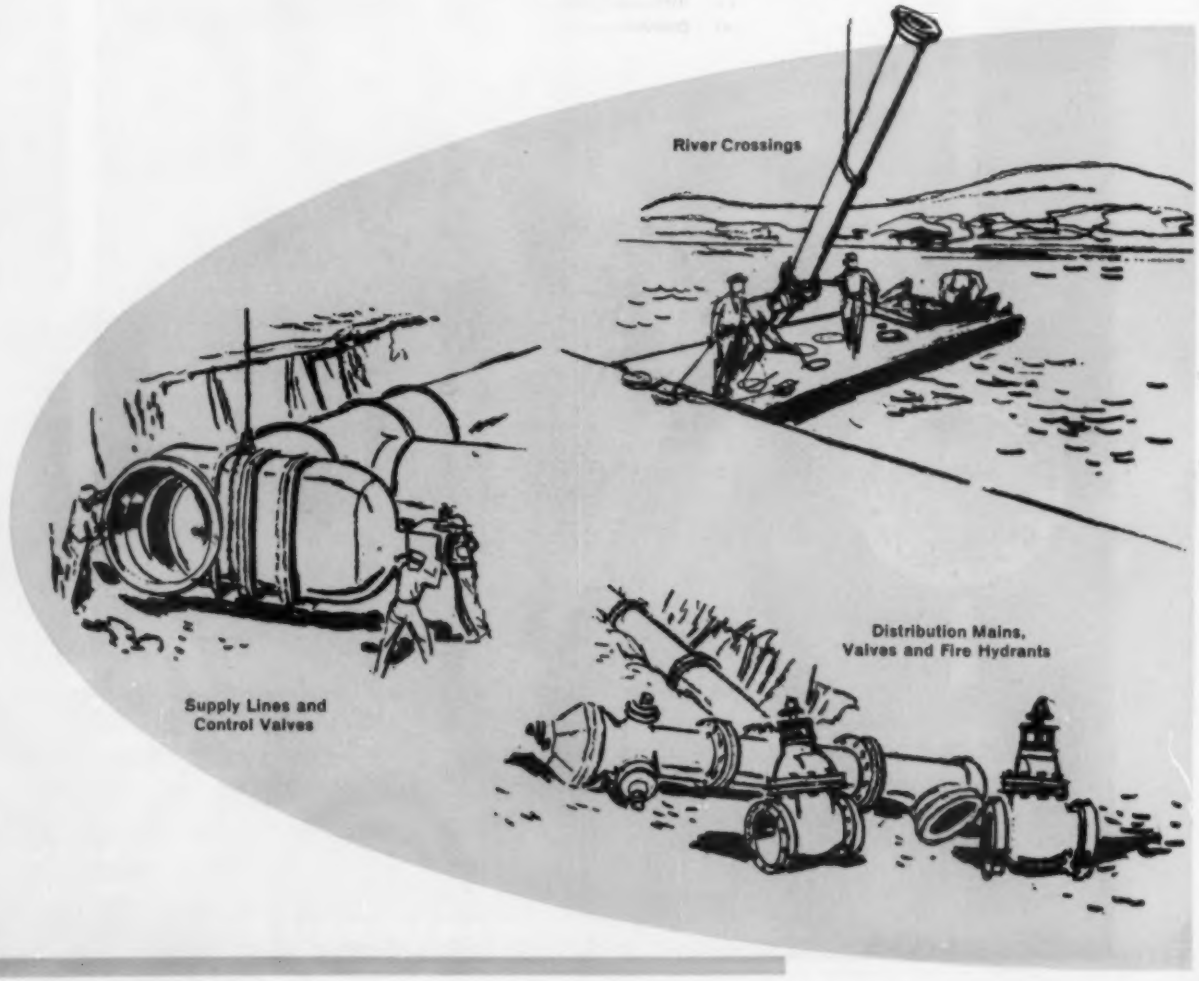

MEET EXACTING SPECIFICATIONS FOR PLANT & DISTRIBUTION SERVICE

For generations...since 1878...public officials, waterworks engineers and contractors have learned to count on CLOW products. Today, whether the need is for superior cast iron pipe, high quality hydrants, valves or fittings, or other waterworks specialties, CLOW products meet the exacting demands of plant and distribution service. CLOW facilities, experience and manufacturing skill are often invaluable in helping solve community pipe problems...in long line or extension mains, fire protection systems, filtration plants, pumping stations ...wherever distribution and control of water under pressure is involved.

Be sure...specify time-tested CLOW materials for *your* job.

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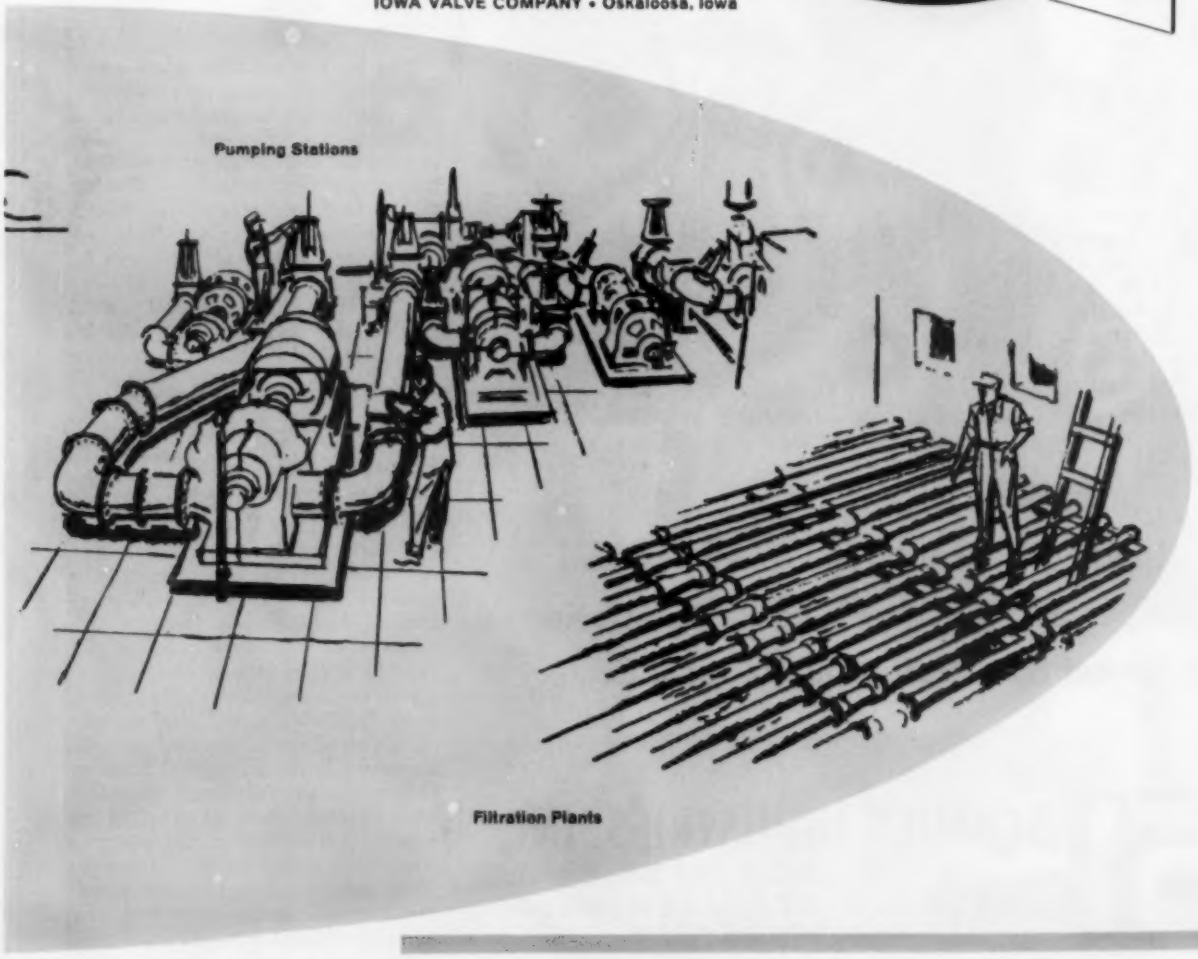
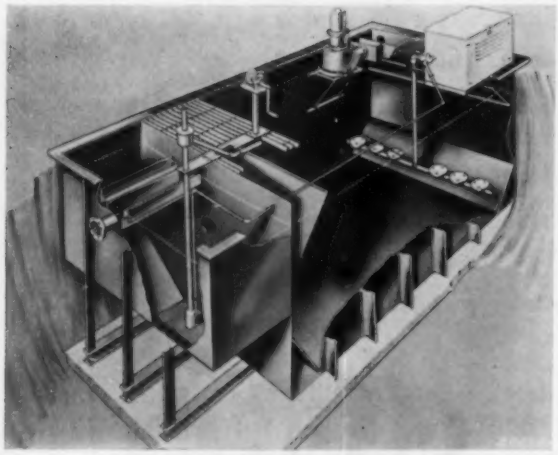
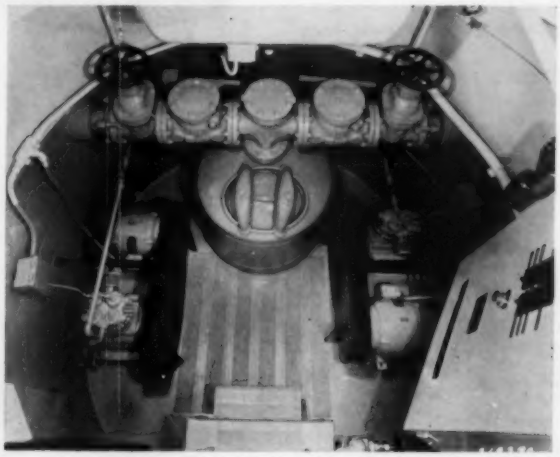
CLOW CAST IRON PIPE



Schmieg packaged lift stations and sewage treatment plants have QUALITY



SCHMIEG CENTRI-SWIRL activated sludge process packaged sewage treatment plants are available in standard sizes from 1000 GPD to 20,000 GPD, and can be equipped with such optional features as froth control; comminutor, sludge holding tank; hypochlorinator and chlorine contact tank.



SCHMIEG CENTRI-JET pneumatic ejectors are available in either Simplex or Duplex models, ranging in capacities from 30 to 100 GPM as standard equipment. Higher capacities for special application are available.

Leading Engineers, Municipalities, and Companies Have Been Specifying Schmieg Equipment For Over a Quarter of a Century

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INCOME AND SALARY SURVEY

This booklet reports the findings of the fifth biennial national survey of NSPE membership. The analyses are based on more than 24,000 replies. Median income for all engineers replying is $10,660, up 6.6 percent from 1958. The 50-page report gives detailed data and comparisons with preceding years. Most engineers will want to see what others are doing. This booklet will help in orientation. $1 for members of NSPE; $2 for non-members. National Society of Professional Engineers, 2029 K St., NW, Washington 6, D. C.

SIMPLIFIED KEY TO SMOLEY'S TABLES

This booklet contains graphic examples and solutions, with their application to the Smoley mathematical tables. It is designed to help, even those with weak mathematical backgrounds, to utilize the Smoley tables and to improve the speed and accuracy of their use. This key will be of special value to men in the civil and mechanical engineering, drafting, architectural, steel fabricating and building fields. Mimeographed; 72 pages; type page 4 by 6 ins.; $1.50 from George F. Wolters, Box 475, Ormond Beach, Florida.

COMMUNICABLE DISEASES IN WORLD WAR II

This is volume V of the history of Preventive Medicine in World War II. It covers those communicable diseases transmitted through contact or by unknown means. The principal sections of interest to our readers will be those on hookworm, schistosomiasis, skin infections, yaws, Bullis fever, and viral hepatitis. Other diseases covered include leprosy, tularemia, venereal diseases, Q fever, poliomyelitis and other less well known infections. This is an especially well-written and informative volume; the authors have covered well the military problems and the methods used in finding the answers necessary to give the pro-

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7

offers 7 models of electric submersible dirty water pumps!

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Capacities 85 to 3100 g.p.m.
Port Sizes 1½" to 8"
Complete Voltage Ranges Available

Who but Flygt could offer a complete electric submersible pump line . . . backed by experience gathered from performance the world over. It has taken years, not months, to engineer what is offered today as the most economical and trustworthy pump line on the market . . . with qualified sales and service representatives throughout the United States and Canada.

PUMP BETTER ELECTRICALLY — USE FLYGT

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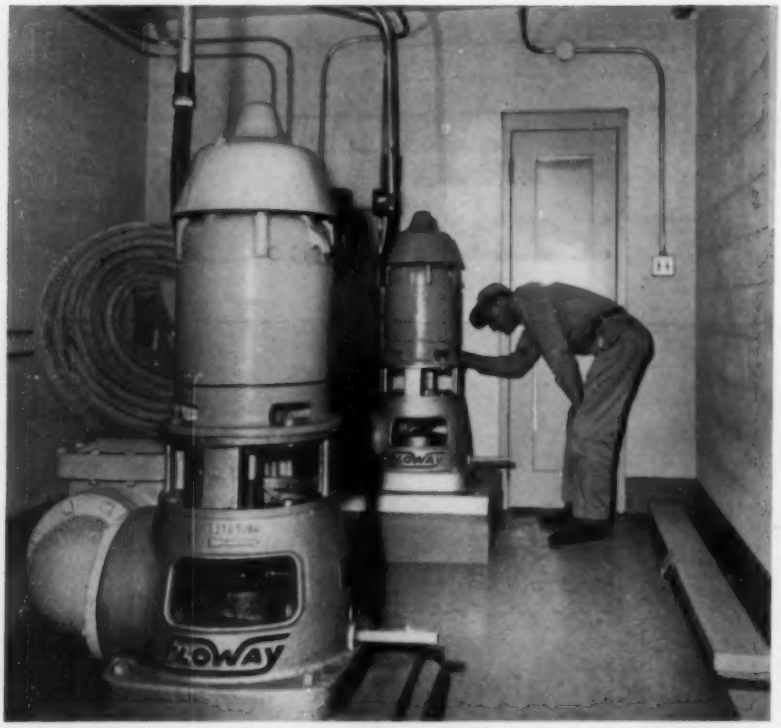
WESTERN SALES & SERVICE: STANCO MFRS. & SALES INC. 1865 Ninth St. (Corner of Olympic) Santa Monica, Calif. IN CANADA:



Two 15 hp, 2-stage FloWay verticals easily fit into Mesa Filter Plant 12' x 18' pump house. Engineer: Black & Veatch, Kansas City. Contractor: Southwest Plumbing & Heating, Colorado Springs.

Pumping 500,000 gallons daily with FLOWAY PUMPS

No maintenance trouble in 2 years

To meet the water needs of the Air Force Academy and 2,000,000 tourists yearly, Colorado Springs in 1959 enlarged the capacity of its Mesa Filter Plant from 8,000,000 to 30,000,000 gallons daily, and "after studying all verticals on the market" installed 2 FloWay pumps. These go on and off automatically at prescribed water levels. Says Foreman Al Lafferty, "We've not had a single minute's maintenance trouble since the FloWay pumps were installed."

Your Choice of Verticals or Submersibles. Verticals for deep and shallow wells, sumps, flood control, emergency water supply, etc. Sizes: 15 to 5000 gpm, 0-1000 psi, 800-3600 rpm. Submersibles from 100 to 4000 gpm, 0-1000 psi, 1750 and 3600 rpm. They operate with high efficiency in wells 8" and larger; also are widely used for vertical or horizontal in-line booster service; can be located beneath street, lawn, or floor; operate silently.

FloWay verticals and submersibles comply with AWWA and Hydraulic Institute specifications, are approved by Corps of Engineers for aircraft refueling. They can handle wide fluctuations in head with comparatively low hp—no need to overdesign or overpower... and they save space.

Bring Your Pump Problems to us. For a fresh look at your pumping problems, consult us. Literature and estimates without obligation. Ask us today for name of nearest representative. Fiese & Firstenberger Mfg., Inc., P.O. Box 164, 2494 So. Railroad Ave., Fresno, Calif.

2

30 YEARS OF PUMP RESEARCH 30 QUALITY

FLOWAY PUMPS

tection to our troops. Some former Sanitary Corps officers will find material reminiscent of their wartime services. There are 41 illustrations; 55 tables; 12 charts and 4 maps; plus 18 appendix tables. There are 27 listed authors and 493 pages. For sale by Supt. of Documents, Government Printing Office, Washington 25, D.C. $5.75.

FACTORS IN SOIL COMPACTION

The contents of this source book on factors that influence field compaction of soils include data on performance characteristics of various types of compactors; methods used to maintain control of moisture content and density; and the results of numerous compaction experiments involving various types of soil and equipment. For the beginner, this bulletin provides a brief history of compaction and also a section on the fundamental knowledge necessary to understand the meaning of soil density, soil moisture content and compaction effort. A separate section is devoted to developments in compaction equipment. Another section presents state highway practices expressed in terms of specification requirements for compaction of various elements of the road structure. Still another section presents manufacturers' specifications for compaction equipment. 254 pages; from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.; $4. Ask for Bulletin 272.

PRECAST CONCRETE BRIDGE UNITS

This reports a study sponsored by the Missouri Highway Commission and the Bureau of Public Roads by the University of Missouri Department of Civil Engineering. The primary purpose was to analyze standard precast sections under simulated loading conditions to determine the behavior at nominal working loads and the ultimate capacity with respect to flexural or shear failures. Conclusions, in brief, were: 1) The specified minimum compressive strength of the concrete may be lowered; 2) bundling of reinforcement can be used effectively; 3) lightweight concrete aggregate will reduce dead load stresses; 4) higher strength reinforcement might be advantageous; and 5) the diaphragms used were very effective in load distribution. Illustrated; 141 pages; Engineering Experiment Station, University of Missouri, Columbia, Mo.; No. 52; no price given.

NOW! An ice control program that cuts accidents and complaints!

The Morton Safe-T-Salt* Ice Control Program can help you accomplish two important jobs this winter . . . public safety and public relations!

Streets are safer when they are salted with Safe-T-Salt, because it is a screened and graded rock salt that gets rid of dangerous ice and snow in the quickest, safest, most economical way possible.

The name "Safe-T-Salt" was developed to explain this job to the public. As you know, too many uninformed citizens complain about de-icing programs every winter. The "Safe-T-Salt" name will cut down those complaints by emphasizing the safety value of salting treacherous pavements . . . will keep the public aware of your efforts to reduce winter driving hazards.

The truck banner in the illustration above represents one way that safety salting can be made popular. These banners are available free to Morton Salt customers. Your Morton representative can supply them and other material . . . as well as furnishing you with helpful publicity features for your local newspapers, explaining the value of de-icing programs. He'll be glad to help you start planning *now* for a safer and happier winter.

FOR MORE INFORMATION ON MORTON SAFE-T-SALT, MAIL THIS COUPON TODAY

Please have a Morton Salt representative call me for an appointment to explain all the advantages of your Safe-T-Salt program.

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Title_____

Address_____

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MORTON SALT COMPANY

INDUSTRIAL DIVISION

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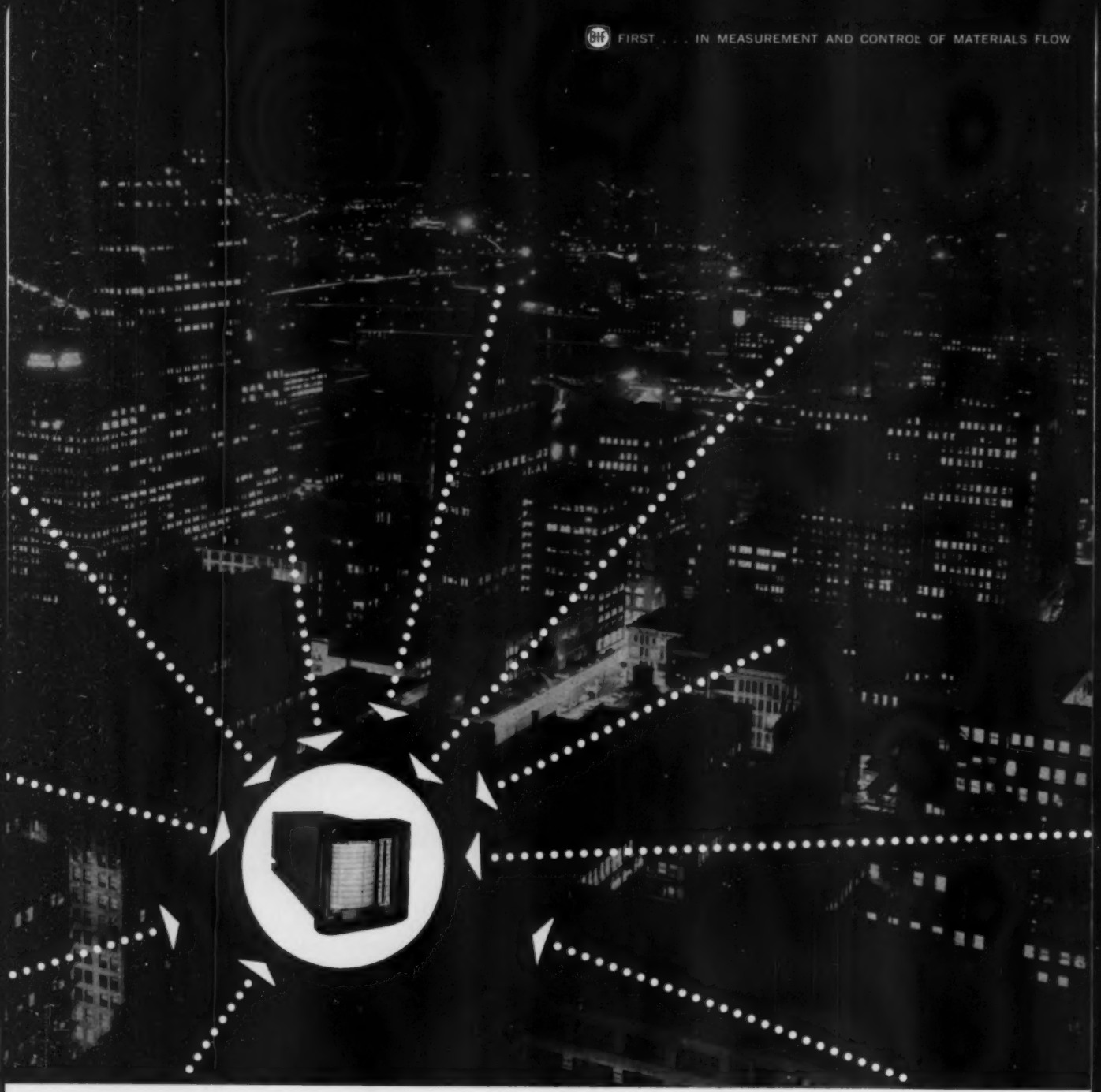
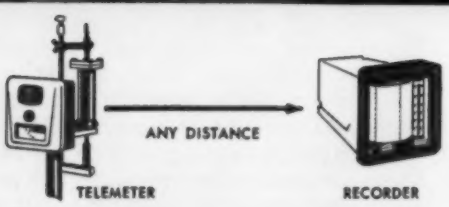
**Safe-T-Salt is a trademark of the Morton Salt Company*

B-I-F FIRST . . . IN MEASUREMENT AND CONTROL OF MATERIALS FLOW



Where others fail...
B-I-F *time-duration telemetering is infallible!*



Miles apart . . . pressure drops, a flow rate changes, a pump fails, a valve sticks . . . all must be instantly, dependably recorded at one central data-gathering station. As infallible as time itself . . . normal variations in line voltages, resistance, inductance, or ambient temperatures do not affect the B-I-F system. Power loss doesn't call for readjustment. Physical quantities are measured in their own terms . . . response is faster . . . need for elaborate off-normal alarm equipment is eliminated . . . all at great savings in cost! From the simplest tank level recording to complex central data handling, B-I-F has the know-how and experience in telemetering and remote control to help you operate more efficiently. Compare B-I-F Chronoflo Telemetering with any other. Request Bulletin 230.20-2 for complete details. Write B-I-F Industries, 356 Harris Avenue, Providence 1, Rhode Island.

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A DIVISION OF THE NEW YORK AIR BRAKE COMPANY
METERS • FEEDERS • CONTROLS / CONTINUOUS PROCESS ENGINEERING

LET US SOLVE YOUR INDUSTRIAL WASTE PROBLEM

Today's modern industries and processes often create industrial waste problems that can actually stall profit-making applications of new discoveries.

Naturally enough, communities feel that public health comes first, and some industrial wastes and acids may eat up sewer lines fast.

At Crystal Lake, Illinois, the Clay Pipe industry has built a modern new research and testing laboratory. Experimentation is constantly going on to test pipe and jointing materials to see which is actually the best under all conditions for sanitary and industrial wastes.

Tests show that Vitrified Clay Pipe with its new resilient self-sealing joints is impervious to the corrosive action of sanitary sewerage and industrial wastes and acids which normally flow through sewer lines.

But yours may be a special problem. Let us help you with it. Write, outlining the problem to be tested, to:

COMPRESSION SEALED, VITRIFIED

CLAY PIPE

IMPERVIOUS

THE STANDARD in SANITARY SEWERS

NATIONAL CLAY MANUFACTURERS, INC.
1028 Connecticut Ave., Washington, D. C.

Please send me full details on the new factory-made compression joints on Clay Pipe.

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EXCLUSIVE ONE-PIECE CAB-BODY DESIGN gives Ford Styleside Pickups extra capacity and extra strength. Heavy duty in every way for heavy going all day! And there's carlike riding comfort thanks to Ford's long wheelbase and exclusive *Driverized* Cab!

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NEW '62 FORD TRUCKS

Get full-time economy that only starts with Ford's low price!

Meet the trucks that make saving money a full-time business—new Ford Trucks for '62!

In a selection of over 600 models there's a truck that's right for your job, whatever your job . . . trucks that you can buy and operate at lower cost . . . trucks that can save you money mile after mile, load after load, year after year!

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FORD TRUCKS COST LESS

SAVE NOW . . . SAVE FROM NOW ON!

ECONOMICAL HEAVY DUTY V-8's with 292-, 302- and 332-cu. in. displacement give you tailored-to-the-job economy at much lower prices than you would expect in trucks with engines of this size. Stress-relieved cylinder heads, aluminum alloy pistons and sodium-cooled exhaust valves are but a few of the heavy-duty features you get with these engines.

ECONOLINE — ALL-ROUND ECONOMY LEADER — and low price is only the start! Certified tests show this pickup may save $100 on gas, oil, tires and license over your present conventional pickup every 16,000 miles you drive.

AMERICA'S MOST POPULAR VAN — and small wonder! Econoline savings start with a price far under any popular ½-ton conventional panel on the market! And they continue saving every day—certified tests have shown that in 16,000 miles, savings in operating costs compared to the conventional panel you may now own could top $100! Big 4-ft. doors rear and curbside plus 204 cu. ft. of loadspace, and a floor that's flat the full length, mean easy cargo handling.

PROVEN 262-CU. IN. BIG SIX FOR FORD MEDIUMS includes more heavy-duty engine features than any other Six of its size. Never before such long-term durability, reliability, and economy at so low a price.

PRODUCTS OF Ford MOTOR COMPANY

"All you're gonna do is
scare the fish cousin Ferd...
you ain't goin' to find
no leaks in them joints"

U.S. cast iron PIPE FOR WATER, SEWERAGE AND

not a leak in a lakeful!

The joints on USIFLEX® Boltless Flexible Joint Pipe are bottle-tight. Joint is made up with a moderate thrust to move ball past self-sealing gasket in socket. Rugged retainer ring locks joint against pull-out during installation and in service. And no wrenches, bolts or nuts to worry about.

Underwater jobs are never easy. But Usiflex simplicity, speed and ease of handling make them almost a pleasure. Want to cut costs, save time and labor next time you have a tough underwater job? Call or write today for illustrated technical brochure on Usiflex.

U. S. PIPE AND FOUNDRY COMPANY
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A Wholly Integrated Producer from Mines and Blast Furnaces to Finished Pipe.

Makers of TYTON JOINT® Pipe.

USIFLEX®
BOLTLESS FLEXIBLE JOINT* PIPE

*U. S. Patent No. 2,984,938

INDUSTRIAL SERVICE CAST IRON

1 Insert the gasket in its seat in the socket. Forming gasket loop helps initial stage of seating. Release of loop allows gasket to spring into the gasket seat where it is securely held.

2 Apply special Usiflex lubricant to the ball and inside surface of seated gasket in socket. After lubrication, ball is ready to be pushed into socket.

3 Ball has been socketed. Retainer ring lugs have been lined up with recesses in bell and retainer ring is ready to be moved into the bell and rotated.

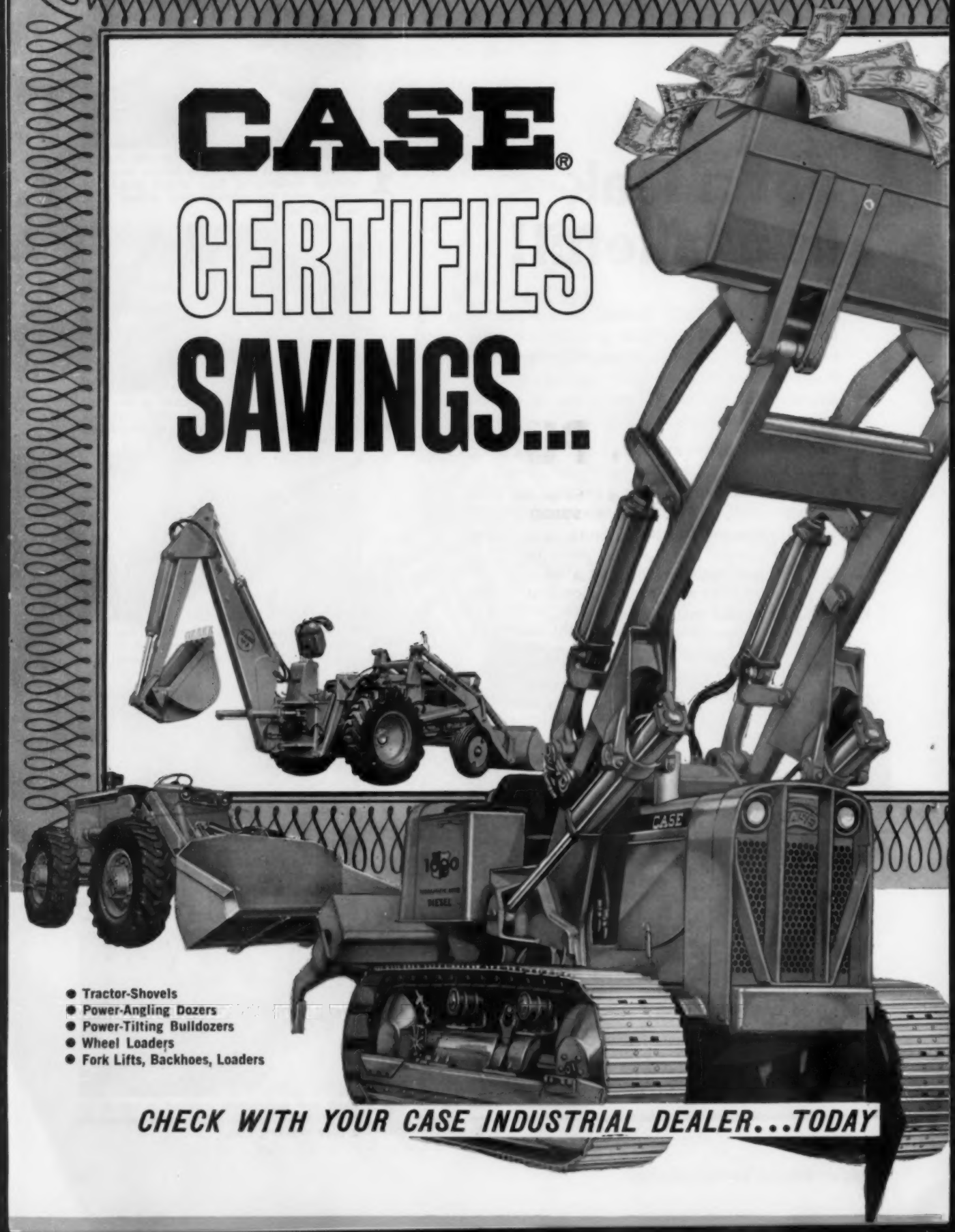
4 After insertion and rotation of retainer ring in bell, the lugs on retainer ring are in back of and in register with internal flange segments in bell. Lead lock is partially inserted into recess between the bell and retainer ring.

5 Lead lock completely inserted in recess is being caulked in place by hammer blows on a wide caulking iron.

CASE®

CERTIFIES

SAVINGS...



- Tractor-Shovels
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- Fork Lifts, Backhoes, Loaders

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The savings are certified to be as represented — $200, $500, $1000, up to $2000 on some models.

Price alone doesn't justify the buying of a piece of equipment. But *these* are machines with double-barrelled savings . . . big savings in initial cost PLUS money-making performance that pays dividends every day they work for you.

You'll find the machine that's just right for you in this seasonal clearance sale IF you act now. CASE CRAWLERS with exclusive Terramatic® Transmissions that speed up the pace of production and insure a better margin of profit on close-bid jobs. WHEEL TRACTORS with torque converter drive and an unequaled selection of Case-built backhoes, loaders, fork lifts. WHEEL LOADERS with safety-engineered balanced design that eliminates bucking, nose-diving and side-sway.

You pick the machine . . . and your Case Industrial dealer will *prove* its money-making ability in an on-the-job demonstration. Quote you the deal of a lifetime too . . . all at no obligation. Call him now! J. I. Case Company, Racine, Wisconsin.

A DEMONSTRATION

will show you how

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Industrial Equipment Keeps your

PROFITS ROLLING IN!

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NEW LISTINGS

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348. This is title of a 96-page book to aid truck owners in obtaining improved service and performance from any truck of any make or model. Covers everything from insurance to maximum gas mileage. Get your free copy from Truck Marketing Dept., Ford Motor Co., P. O. Box 608, Dearborn, Mich., or use our reply card.

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349. New 8-page illustrated booklet describes complete line of single stage, double suction horizontal centrifugals. Includes sectional photos, dimensional data, selection and limitation charts. Capacities up to 6000 GPM, heads to 380 feet. Write for Bulletin 105C to Aurora Pump Div., N. Y. Air Brake Co., Aurora, Ill., or check our card-number.

Home Garbage Disposal by Disposall

350. Brief 4-color bulletin tells about disposall: What it does, why it works, what advantages it holds for the housewife and the municipal sewage disposal system. Write for Pub. No. 38-351 to General Electric, Disposall Dept., Appliance Park, Louisville 1, Ky., or use reply card.

Automatic Regulation of Variable Speed Drive for Pumping Stations

352. Applicable to both water and sewage pumping, pressure or float operated. Will program multiple constant and variable speed drives to match any required pumping capacity. 4-page illustrated Serv-trol folder gives full information. Address Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn., or check our card-number.

Controlled Feeding of Liquids and Solids

353. As applied to water and sewage treatment. New 8-page brochure lists, describes and illustrates available B-I-F equipment for many purposes. Write for Bulletin Ref. No. 4.20-1 to B-I-F Industries, P. O. Box 276, Providence 1, R. I., or circle the card-number.

Compact Sewage Treatment Plants

355. Latest data are in new 12-page color illustrated brochure with drawings to show operating features and practices. Applicable to housing developments, institutions, industries and other places where municipal treatment is unavailable, 15,000 to 180,000 gpd. Write for Bulletin No. 7330 to Dorr-Oliver, Inc., Stamford, Conn., or check our number.

Don't Argue About Odors, Send for this Booklet!

361. Controlling offensive odors inexpensively is the theme of the new 20-page Ozene booklet. Write for it as brochure CC-1 to Solvay Process Div., Allied Chemical Corp., 61 Broadway, New York 6, N. Y., or use reply card.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Vertical Turbine Pumps

357. Described in an unusual 4-color illustrated brochure that you will want in your pump data files. Write for it by above title to Fiese & Firstenberger Mfg., Inc., 2494 Railroad Ave., Fresno, Calif., or use our card.

For Positive Safety in High Places—

358. Working on power line poles or street light maintenance, or for tree work, there's the Spiralloy boom with complete insulation. Even keeps the truck from being energized. For all the details write for Spiralloy bulletin to Asplundh Chipper Co., 501 York Road, Jenkintown, Pa., or check our card-number.

Area Lighting Designer's and Buyer's Guide

362. Is the title of this new booklet called a key to the whole area-lighting line-up. Describes all luminaires, controls, poles, and area-lighting hardware plus illustrated application data and installation recommendations. Write for publication GEA-7223 to General Electric Co., Schenectady 5, N. Y., or check number on card.

New Quick-Connection Backhoe

363. Designed for use with Caterpillar wheel tractors. 2-color booklet shows how 30-second connection or disconnection is possible. Contains complete specifications and working range chart. For yours, request Form No. CLX-6112 from Equipment Div., Young Spring & Wire Corp., Bowling Green, Ohio, or just circle our card-number.

"The Well That Never Runs Dry"

373. Titles beautiful color booklet with interesting story of water shortages and how desalting sea water is becoming a reality. Write for your copy by above name to Fairbanks, Morse & Co., 100 Electra Lane, East Station, Yonkers, N. Y., or check our card-number.

Readers' Service Index

New Catalogs .....pages 34 & 36
Weed Control .....page 36
Streets & Highways .....page 38
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Sewerage & Waste page 46 & 48
Business .....page 52
Refuse .....page 52
Lighting & Traffic .....page 52
Snow & Ice Control .....page 52

Hinged and Rotary Pipe Cutters

377. 16-page new catalog with pages of special interest to water works people. Describes and illustrates in color six basic lines, from tubing cutters, to 30" iron or steel pipe ones. Includes prices and technical data. Write to Reed Mfg. Co., Erie, Pa., for catalog No. NP-6-61 or use our card.

Extend Sludge Filter Cloth Life

378. By proper cleaning, 4-page two-color folder tells how it can be done. Cleaning unit claims to pay for itself through extending cloth life, plus less down-time, better dewatering and sludge cake. Write for this brochure to Hydro Silica Corp., Gasport, N. Y., or check our card-number.

Bulletin on Bitumuls for Hot-Mix Pavements

382. 4-page folder gives complete information on Laykold Asphaltic Concrete for heavy traffic demands or Bit-u-mix for isolated areas without mass-handling facilities for hot asphalt. Write for Bulletin A-32 to American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif., or send in our reply card.

Portable Transit Mixer for Concrete

385. Illustrated Bulletin describes and illustrates this versatile portable mixer for the IHC 460 tractor. Write for "Portable Mixer" bulletin to Dotmar Industries, Inc., 502 Hanselman Bldg., Kalamazoo, Mich., or check off our card-number.

New Soil Exploration Equipment

388. A new informative brochure on soil sampling machine that adds to the growing literature in this important field. Four pages of facts and figures, fully illustrated. For your copy, write Giddings Machine Co., 405 Pine St., Fort Collins, Colo., or check our card number.

Industrial Loader and Hydro-Trencher

389. This one is designed for the Oliver 550 tractor, and users of that machine will find a 4-page folder filled with handy information as well as good pictures and diagrams. Get your copy from Ware Machine Works, Ware, Mass., or use our reply card.

Water Filters and Softeners

396. New 4-page bulletin describes and illustrates such items as pressure filters, ion exchangers, demineralizers, water softeners and waste treatment systems. Write for free bulletin to Dept. 61, Industrial Filter & Pump Mfg., Co., 5900 Ogden Ave., Cicero 50, Ill., or check number on our card.

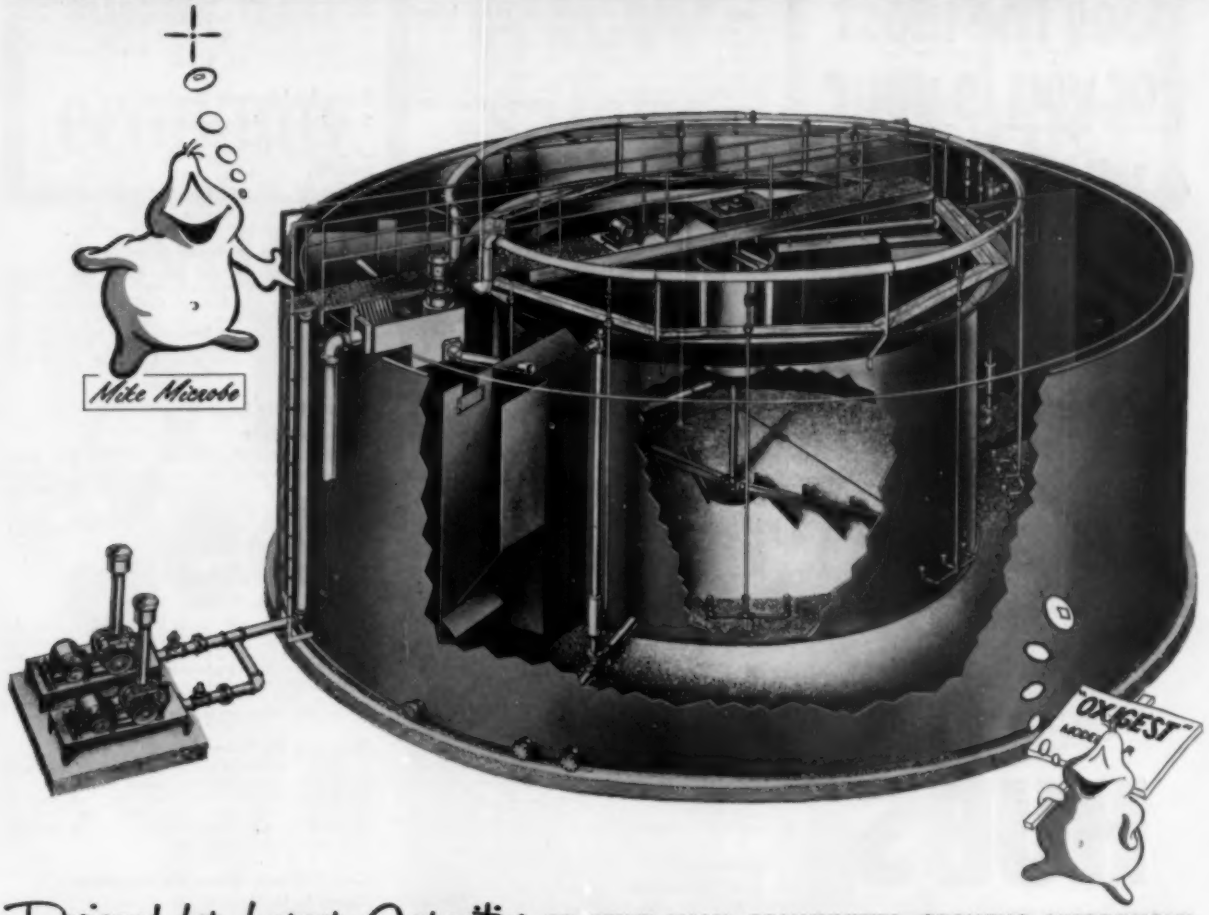
Digital Data Recording and Alarm Scanning System

398. Beautiful color-illustrated brochure describes applications and principles for virtually any type or combination of analog values. Get your free copy from Monitor Systems, Dept. 33, Fort Washington Industrial Park, Fort Washington, Pa., or use the reply-card.

Low-Cost High-Speed Refuse Handling

399. Refuse container handling system fully described and profusely illustrated in 20-page booklet issued by established manufacturer of truck loaders. For your copy, address LoDal, Inc., Norway, Mich., or check our card-number.

S&L FIELD-ERECTED SEWAGE TREATMENT PLANT



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For complete engineering data manual on field-erected and factory-built Sewage Treatment Plants write department 40.

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Warn Mfg. Co., Inc.
Riverton Box 6064-P
Seattle 88, Wash.

NEW LISTINGS (Cont.)

Inspection Manual for Hot Dip Galvanized Products

390. Galvanized products are easily inspected when the proper criteria dictated by the function and the nature of the coating are applied. The purpose of this 32-page Manual is to establish and explain these criteria. Get your copy from American Hot Dip Galvanizers Assn., Inc., 5225 Manning Place, Washington 16, D. C., or use reply card.

Slotted Screen Pipe for Water Wells

394. 8-page well-illustrated brochure tells and shows what you need to know about this important product. Two pages devoted to specifications and dimensions. Write for Catalog 62-63 to Emsco Screen Pipe Co. of Texas, Inc., P. O. Box 14446, Houston 21, Texas, or use reply card.

New Fibre Pipe Information

400. 12-pages, two-color, detailing practical applications for modern bituminized fibre pipe for corrosive liquids, sewage disposal, drainage. Well illustrated and includes dimensions, fitting specifications, etc. Write for it to Bermico Div., Brown Co., 150 Causeway St., Boston 14, Mass., or use reply card.

Sluice Gates

402. A new handbook just out on installation, operation and maintenance of sluice gates. It is pocket-size, illustrated with instructions on handling, installation and adjustment. For yours, write Rodney Hunt Machine Co., Water Control Equipment Div., Orange, Mass., or check our card-number.

End Skid Dangers on Open Grid Bridge Floors

404. 8-page brochure describes and illustrates how new non-skid studs make such bridge flooring safer in bad weather. Show application on important bridges in Cincinnati and Seattle. Gives AASHO specifications recommended for adoption. Write for this booklet to Nelson Stud Welding Div., Gregory Industries, Inc., Lorain, Ohio, or check number on our card.

Use The Reply Card

Pumps—Reciprocating, Rotary and Centrifugal

405. 16-page booklet, profusely illustrated, with much miscellaneous data, yet non-technical and of primary interest to those desiring a basic knowledge of pumps. Address Goulds Pumps, Inc., Seneca Falls, N. Y., or use our card.

Odor Elimination Chemical

406. To eliminate odors from garbage dumps, sewage, and many industrial wastes and landfills. Depends on low concentration in water. Technical information and prices from The Clarkson Laboratories, Inc., 1450 Ferry Ave., Camden 4, N. J., or by checking our card-number.

Automatic Gravity Filter

408. New bulletin describes construction, operation and applications of MONOVALVE filter. Contains flow diagrams and dimensioning data that engineers and heads of water works will find valuable. Write for BulletinWC-130 to Sales Promotion Mgr., Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y., or use reply card.

Packaged Water Treatment System

410. 8-page illustrated brochure, in color, explains principles and advantages of the Heli-floc System for disinfection, clarification and filtration. Includes scale diagrams and chart showing equipment dimensions. Write for Bulletin CWP-100 to Met-Pro, Inc., 5th St. and Mitchell Ave., Lansdale, Pa., or you may use our reply card

Modern Compaction Methods and Equipment

411. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn.

Warn Lock-O-Matic Hubs Manual

412. Warn Hubs make 4-wheel drive more useful because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064-P, Seattle 88, Wash.

Press-Seal Rubebr Gaskets to Seal Joints of Concrete Pipe Sewers

416. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

Construction Materials Tested

418. This is the title of a new 6-page general bulletin illustrating and describing briefly a complete line of testing machines and collateral apparatus for concrete, concrete products, reinforcing bars and aggregates. Write for it by above name to Forney's Inc., Tester Div., Box 310, New Castle Pa., or check our card-number.

Case History Reports on Coagulants

419. Are offered that will let you draw your own conclusions on how Mogul Claracel has worked in actual water treatment plants on color removal, turbidity or floc carry over. Get yours from The North American Mogul Products Co., Standard Bldg., Cleveland 13, Ohio, or use the reply card.

For Working Aloft on Trees, Lights, Wires

420. You will profit by knowing first the advantages of the SKYWORKER. Described and illustrated in 6-page bulletins in color are these hydraulic, truck-mounted aerial lifts for your personnel. For yours, address Hughes-Keenan Div., U. S. Air Conditioning Corp., Delaware, Ohio, or circle the card-number.

Vacuum Up Those Leaves

422. How? There's a circular that tells and shows how to collect leaves off your streets by vacuuming yet no "fall out" of dust to annoy your taxpayers. Just write for Leaf-Vac literature to Baughman Mfg. Co., Jerseyville, Ill., or use our reply card.

Cut Highway Grass Maintenance Costs in Half

423. With a chemical growth-retardant that replaces much mowing. Full details await you in Bulletin on MH-30. Just address Naugatuck Chemical Div., U. S. Rubber, Dept. A, Elm St., Naugatuck, Conn., or use our card.

Self-Propelled Ditchers of All Sizes

427. Information on the Vermeer line of self-propelled, one-man operated ditching machines. Years of experience in the light construction field. Model 524T digs 8 to 24 inches wide, 6 feet deep. The model 4T digs 6 to 14 inches wide, 4½ feet deep. Two new all-hydraulically-controlled ditchers. Model W-3 digs 3½ to 12 inches wide and 4 feet deep. Model W-1 compact size digs up to 6 inches wide and 40 inches deep. W-1 and W-3 available on rubber or crawler tracks. Model 3P fits on all tractors with standard 3-point hitch. For literature, check the reply card or write Vermeer Manufacturing Co., Pella, Iowa.

WEED CONTROL

Weed Control Deserves a Program

45. You can get a lot of valuable guidance on how to use two weed control herbicides available as wettable powders or granules to give season-long control. Get descriptive brochure GAC 630. Address Geigy Agricultural Chemicals Div., Saw Mill River Road, Ardsley, N. Y., or ring number on our card.

Weed and Brush Killer Cartoon Book

253. A novel "Western" approach is used in a cartoon-style booklet to dramatize herbicides for brush control along rights-of-way and mixed brush and weeds. Write for "Diamond Deputies." You and your kids will both profit from it. Address Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, or use our reply card.

NEW economy | NEW safety | NEW efficiency

ON ROUTE DELIVERIES ALL-NEW 'Jeep' FLEETVAN

Payload	1,000 pounds
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Wheelbase	81 inches
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Load Space Volume	170 Cu. Ft.
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Here's the newest, most economical walk-in delivery van you can buy—the sensational new 'Jeep' Fleetvan. Ideal for multi-stop delivery use! The Fleetvan parks easy. Maneuvers easy. New safety-designed front lets the driver see the road just a short way in front of the bumper. And the Fleetvan gives top gas economy too. These are just a few of the reasons the U. S. Post Office purchased over 6,000 'Jeep' Fleetvans. For full information on the 'Jeep' Fleetvan write to Mr. R. J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.

'Jeep' FLEETVAN ®

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To order these helpful booklets check the reply card opposite page 34.

STREETS AND HIGHWAYS

Power Sweepers for Cramped Quarters

91. How to gain the advantages and economies of power sweeping in numerous common smaller areas is the subject of these color-illustrated descriptive sheets. Ask for Bulletins 703-4-5- and 6 direct of Wayne Mfg. Co., 1201 E. Lexington St., Pomona, Calif., or just check our card-number.

How Are Your Bridge Floors?

185. If you face replacements—or plan new bridges—you will find much really helpful data on steel mesh bridge flooring, safety features, tractional surfaces, dimensions, weights, loads and spans in a new booklet offered by Irving Subway Grating Co., Inc., 50-09 27th St., Long Island City 1, N. Y. Includes detail drawings, specifications, also data on bridge sidewalks. Write for "Irvico Decking" booklet today

International Wagner Heavy-Duty Loaders and Backhoes

195. International Wagner loaders and backhoes are matched with International utility tractors and are described in Catalog CR-1369-K available from International Harvester Co., Consumer Relations Dept., 180 N. Michigan Ave., Chicago 1, Ill. Check the reply card.

Don't Haul and Burn Brush, Dispose of It on the Spot

196. How you can do this the easiest way with Fitchburg Chippers is the theme of 16-page illustrated catalog that can save you work and grief. Gives experiences of others and describes simple mounting on truck body or on trailer, tractor or Jeep. Write Fitchburg Engineering Corp., Fitchburg, Mass., or just use reply card.

Hot Roll Street Patcher

286. Brochure describes a heated asphalt roller that makes street repair work easier and more effective. Portable, fits on any truck. Motorized or hand-pushed types. Ask for Hot Roll Booklet from Ellis Distributing Co., 13 South Prairie, Liberty, Mo., or check our card-number.

Compact Trencher Thrives On City Work

246. Problem trenching locations in city and surburban work where obstructions prevail are neatly solved by the Cleveland Model 92 "Baby Digger," a small, compact, tough trencher. Full description, specifications and many photos in Bulletin L-108 give the full story. Write Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

New Tractor Shovel Specification Bulletin

315. Just released, discusses salient features and gives detailed specifications of Model 254 Trojan shovel. Get your copy from The Yale and Towne Mfg. Co., Trojan Div., Batavia, N. Y., or use our reply card.

The Versatile Jeep

333. Inform yourself of its many varied uses and advantages with the new 4-page in-color folder showing the full line, with major specifications. Address R. J. Kreusser, Fleet Sales Manager, Willys Motors Inc., Toledo 1, Ohio, or use reply card.

Manual on Steel and Wire for Road Building

337. Design data on wire fabric for concrete pavements, joint data, cable highway guard, wire fabric, steel and wire for concrete pipe and reinforced bituminous concrete design are some of the sections covered. Check the reply card or write American Steel & Wire Div. of United States Steel Corp., Cleveland 13, Ohio, for this valuable manual.

Versatile Trenchers Mount On Jeeps or Tractors

504. "Gear-Draulic" boom-type trenching attachments by Auburn mount on tractor or Jeep, give new utility to your equipment. Get descriptive brochures from Auburn Machine Works, Inc., Auburn, Nebraska. Use the inquiry card.

What Henry Didn't Know About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

Big Tractor-Powered Equipment

540. Including tractor shovels, dozers, scrapers, loggers and special equipment models and features illustrated and described in attractive brochure available from Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich. Or just check number on our card for us to order for you.

Now, a "Snap-Mount" Backhoe

630. Attaches or detaches in 30 seconds, without tools. This is only one of the advantages of this equipment as described in 6-page folder. Write for booklet on Model 110 Hopto, to the Warner & Swasey Co., Badger Div., Winona, Minn., or circle above card number.

Design of Concrete Pavements For City Streets

657. Sections covered in this manual are classes of streets as to traffic, quality of concrete, working stress and safety factor, types of pavement design, design procedure, jointing of municipal pavements and use of distributed steel. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

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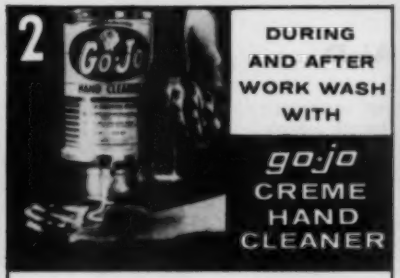
Helping squelch trouble before it begins, new Go-Jo Liquid Protective Skin Coat creates an invisible, greaseless barrier that prevents dirt and irritants from entering the pores. Liquid Protective Skin Coat does not impair sensitivity as do gloves and will not affect materials handled.



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The Go-Jo Heavy Duty Dispenser cuts handcleaning costs up to 75% by delivering the right amount of Go-Jo Creme Hand Cleaner for a quick, thorough clean-up. Precision engineering eliminates waste.

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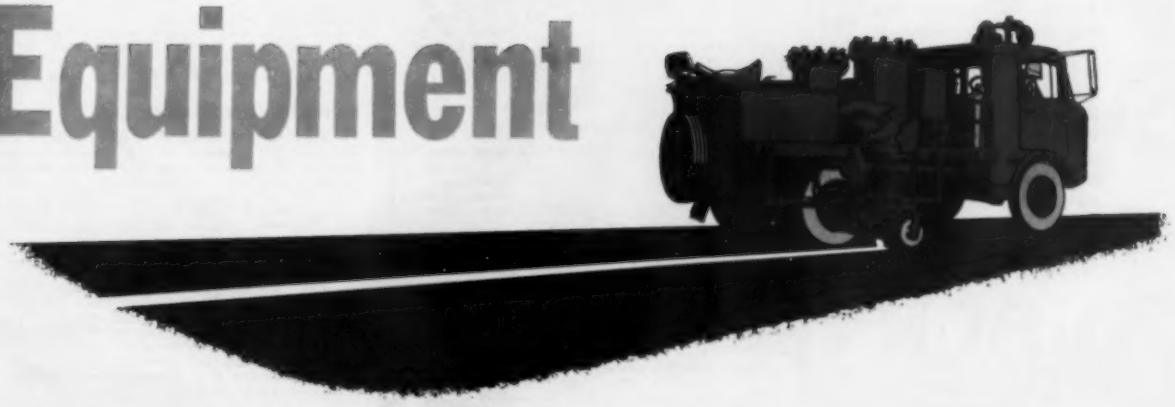
Creator of the World's Most Advanced Striping Equipment



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At Wald, research is a major project. But that's how we find better ways of striping highways, streets, airports and industrial areas. Wald engineers and fellow-experts have touched off a number of revolutions in striping equipment. We seek and study, we build and test, with one consuming ambition . . . to ease the highway safety problem. It is no accident that Wald leads the field.

Wald accomplishments owe a great deal to the many state and municipal customers whose foresight and suggestions sparked some of our finest developments. **Herewith our warmest thanks, with firm assurances that Wald will continue to do its best to fulfill requirements, regardless of how exacting.**

Send for catalog W-58

WALD INDUSTRIES

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HUNTINGDON, PENNSYLVANIA

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A GOOD TRENCH from a hole in the ground

Let's face it. Nobody buys a trencher. They buy mile after mile of trench! Your problem is to get your underground plant in as fast and efficiently as you can.

How to do it? Get the trencher that costs less to operate and maintain, avoids costly downtime, yet puts up to 800′ of clean, smooth trench behind it every hour! Get an Auburn Gear-Draulic Trencher. This rugged, one-man trencher penetrates fast, cuts from 6" to 14" wide, down to 6′ deep. Digging chain, with patented alloy steel cutting bits, prevents jamming or clogging, under wet or clay conditions. Gear-draulic drive automatically adjusts speed to changing soil conditions, serves as safety factor against hidden objects.

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Each Auburn model is specifically designed for the tractor or jeep on which it is to be installed. Models available for: INTERNATIONAL HARVESTER industrial tractors, FORD 4-speed transmission tractors, MASSEY-FERGUSON Work Bulls. Also available for WILLYS JEEP.

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Phone: BRidge 4-3141

To order these booklets check card opposite page 34.

WATER WORKS

Push-Type Cast Iron Pipe Joint

22. New brochure describes and illustrates pipe with this important development known as American "Fastite" joint. Offered as a superior double-sealing single gasket type of joint. Book also contains full specifications. Address American Cast Iron Pipe Co., P. O. Box 2603, Birmingham, Ala., or check our reply card.

Chlorine Handling Methods and Materials

27. A group of technical bulletins which discuss safe handling practices for chlorine, cylinder connection, flexible metallic hose and chlorine valve maintenance are available from Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa. Get this helpful material by checking the reply card.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 23, Wis. Check the card for details on these accurate meters.

How to Select Right Angle Drives

62. Data-filled Catalog 31 & 32 of Johnson Gear & Mfg. Co., Ltd., 8th & Parker Sts., Berkeley 10, Calif., makes it easy to select the correct right-angle gear drive for deep well turbine and other vertical shaft pumps. Includes details on the Johnson "Redi-Torq" gear drive. To get your copy just check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Controlling Water in Masonry

101. . . . confronts and puzzles practically every building owner, designer or builder. There is still no "wonder drug" cure-all, but a very valuable 44-page booklet is available that goes farther in diagnosis and suggested remedies than anything we have yet seen. Your copy of "Walls Breathe" can be had from Western Waterproofing Co., 1223 Syndicate Trust Bldg., St. Louis 1, Mo.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 55-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

The Design and Function of Elevated Steel Water Tanks

179. A 20-page bulletin of engineering information with illustrations of typical installations, emphasizing ellipsoidal, radial cone and spheroidal designs, may be obtained by writing Chicago Bridge and Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. or by checking the reply card.

A Comprehensive Handbook on Water Meter Settings

174. "The Engineering of Water Meter Settings" contains 34 pages of clearly illustrated data and specifications to help improve your practices and simplify your work. Every Water Department should have a copy of this valuable reference book. To get yours address Ford Meter Box Co., Inc., Wabash, Indiana, or use the inquiry card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or Write to The Preload Co., Inc., 355 Lexington Ave., New York 1, N. Y.

Volumetric Dry Feeders

202. Bulletin gives full details on operating and design features. For valuable technical data on them write for Catalog No. 320.130 from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or use our reply card.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Valves for Concrete Pipe

208. And no adapters needed. That is the title and the message of this new illustrated brochure in color covering this specific problem in using this type of pipe. Double disc valves with O-Ring Joints are fully discussed. Get Circular No. 26 from M & H Valve & Fittings Co., Anniston, Ala., or use our reply card.

U. S. Tyton Joint Pipe

210. An eight page booklet on centrifugally cast, Tyton Joint® pipe for water or other liquids is available. Tyton Joint cast iron pipe is provided with a simple, sturdy and tight slip-on type of joint. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Bell and Spigot Joint Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. M. B. Skinner & Co., South Bend 21, Ind.

How to Make Pipe Cutting Easier

233. Start by getting free folder describing equipment that does this, with operating instructions and full information. Write for catalog to Wheeler Mfg. Corp., Box 688, Ashtabula, Ohio, or use our reply card.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treoatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

PRECAST CONCRETE SEWER ELEMENTS

for lasting service at low cost

American-Marietta offers concrete manholes and a variety of pipe styles—each precast for faster installation at less cost—each designed to do a specific job better. A-M Concrete Products plants are strategically located throughout the country to assure quick delivery. Write for the name of the plant nearest you and ask for free literature on any of the products illustrated below.

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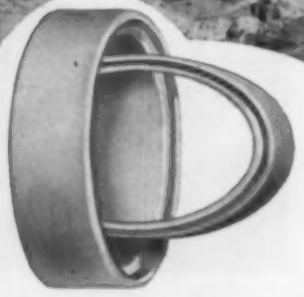
Saves trench width in congested areas



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Minimizes surface excavations, makes salvaging of old sewers easier

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CONCRETE PIPE

Strengths pretested to eliminate guesswork

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calcium chloride
94-97%

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calcium chloride
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DOW

To order these booklets check card opposite page 34.

Cut Down Your Underground Explorations

276. . . . for buried pipe by knowing where it is before you start digging for it. "Typical Pipe Detection Problems and Their Solution" is the title of a free 24-page illustrated, pocket-size book that tells you how to find and determine the depth of buried pipes, conduits, wires and cables. Address Tinker & Rasor, 417 Agostino Road, P.O. Box 281, San Gabriel, California, or check above number on our card.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernah Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

Catalog on Dewatering Pumps

326. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP-1, from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

For Prompt Service Use The Reply Card

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Selection of a Small Packaged Air Compressor

387. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

Water Works Couplings, Clamps and Sleeves

426. Fully described in useful 24-page booklet covering all your pipe needs. Ask for "Water Works Catalog" of Dresser Mfg. Div., Bradford, Pa., or just circle the number on this card.

Vertical Turbine Pumps

508. . . . with a history of low maintenance costs and practically no service calls. These data are offered you in the helpful literature to be had from The Deming Co., 293 Broadway, Salem, Ohio. Check number on inquiry card.

Water Meters with Choice of 7 Features

521. . . . and geared to mineral and chemical characteristics of your water. Complete design flexibility built-in to meet varied needs the country over. Get all the facts with Bulletin 58 of Buffalo Meter Co., Dept. PW, 2917 Main St., Buffalo 14, N. Y., or check the card-number.

Manual Answers Your Water Meter Questions

440. This valuable reference covers the complete line of Trident water meters, giving full descriptions of each type and providing also helpful background information on metering and its advantages. Get your copy of the 28-page Trident Water Meter Catalog. Form 421-1, by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Helpful Information on Elevated Steel Tanks

485. Factors to be considered in the selection of elevated steel tanks plus capacities, dimensions and particulars of many attractive designs are provided in 20-page Bulletin 101 of Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh 25, Pa. Use inquiry card to get your copy.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and weight tables, minimum gages for live load strutted and unstrutted, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

To Insert Valves Under Pressure . . .

555. . . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting-in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

A New Drilling Machine for Cuts in Pipe

569. Automatic, cuts up to 12"; and can be successfully operated even by inexperienced personnel to give faster, safer cuts. Take a minute to get this new folder 8881 from Mueller Co., 512 W. Cerro Gordo, Decatur, Ill., or just circle number on our card.

Construction and Application of Butterfly Valves

621. This 32-page bulletin gives fully detailed data on butterfly valves for all types of service. Consulting engineers designing treatment plants will be especially aided by this information. Write for Bulletin 5904 to Darling Valve and Mfg. Co., Williamsport, Pa., or check reply card.

For Pipe Pushing and Pulling, Cut Costs and Time

641. New folder describes continuous-motion machine that eliminates all resetting of grip. Hand or air powered for pipe ¾ to 2 inches. Write for new folder to The Trojan Mfg. Co., 1112 Race Drive, Troy, Ohio or use our reply card.

Water Service Hydrants and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, ¾", 1", 1½" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Measure Water Accurately In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

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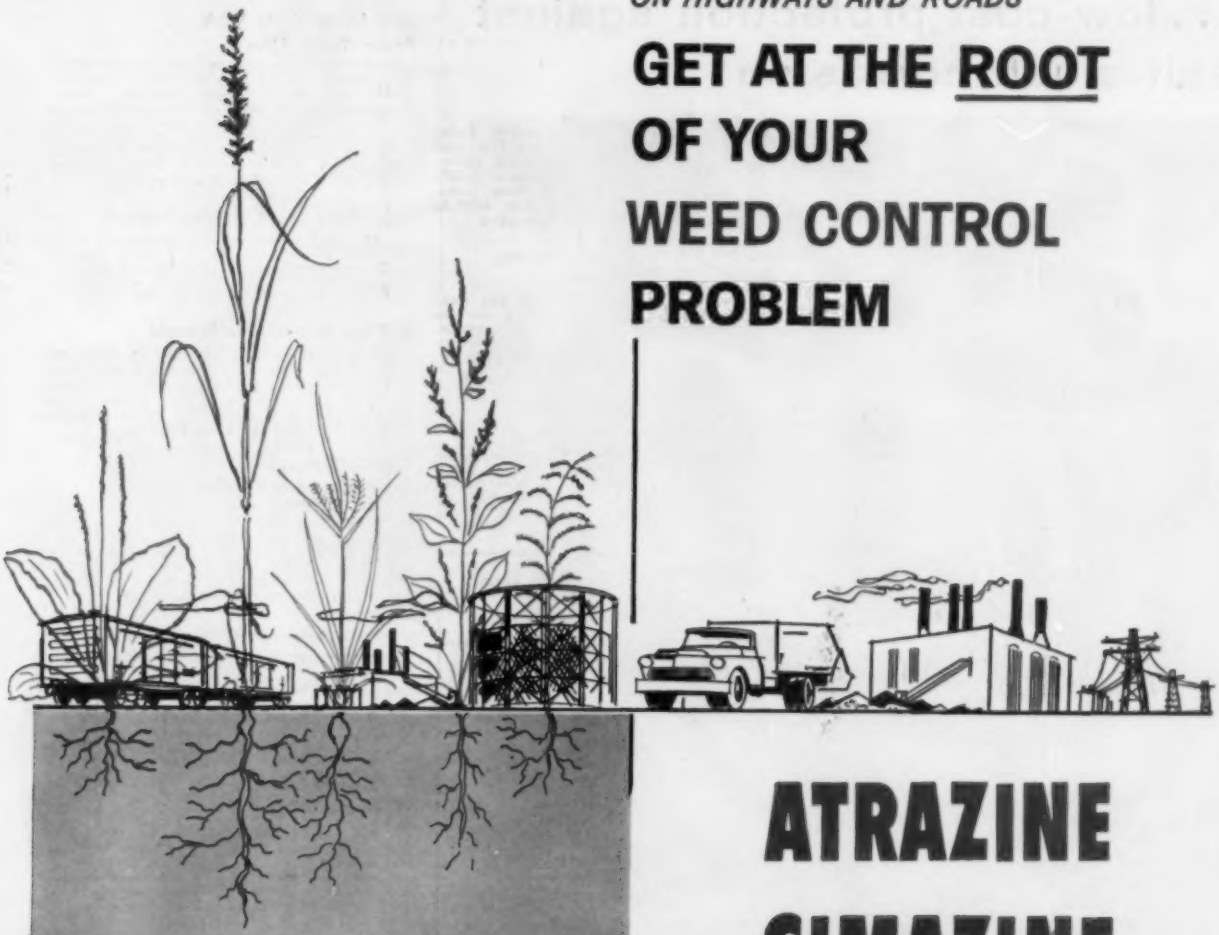
GET AT THE ROOT OF YOUR WEED CONTROL PROBLEM



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Geigy industrial herbicides make possible full season weed control from one application.

Atrazine or Simazine controls both broadleaf weeds and grasses—are non-irritating and low in toxicity to humans and animals. Both provide ease and economy in use.

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To order these booklets check card opposite page 34.

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Rock salt for snow and ice control on roads and streets is both effective and inexpensive. But its corrosive action can turn minor scratches into costly scars. Every metal surface is a prospective victim—cars, trucks, bridges and other public structures and equipment.

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CONSTRUCTION EQUIPMENT AND MATERIALS

Lick Labor Costs With Power Truck Lifts

54. These devices on your trucks substitute mechanical for muscle power, especially suited for loading heavy discarded items. Booklet details the range of these platforms for the nine individual series of power gates, plus a combination of power gate and dump body unit. Ask for booklet PG-6005 from Equipment Div., Young Spring & Wire Corp., Bowling Green, Ohio, or check our card-number.

New Literature on Tractor Loaders

55. Full illustrated descriptions on Allis-Chalmers TL-12 and TL-14 Tractor Loaders are furnished in bulletins MS-1386 and MS-1373 respectively. Write Allis-Chalmers Construction Machinery Div., Milwaukee 1, Wis.

A Tape Measure on Wheels

272. You walk with it and it clocks off feet and inches like an automobile speedometer. Circular describing its many public works uses and full details available on request from B. G. Reilly Co., Box 231, North Scituate, R. I. or by using our reply card.

How to Get Better Concrete Bonding

307. Whether your problem is bonding old to old concrete, new or fresh concrete to old concrete, or remedial patching and anti-skid surfacing, there is help in a very new informative booklet on Thiokol liquid polymer epoxy concrete adhesive. Just write Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.

Added Loader Attachments Add More Mileage for Your Tax Dollar

383. . . . are the intriguing title and content of this handy 16-page pocket-size booklet listing new equipment and new uses for the PAYLOADER you have or the one you are going to get. Ask for "More Mileage" from the Frank G. Hough Co., Libertyville, Ill.

Tractors and Equipment for Municipal Use

407. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations. John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Complete Line of Asphalt Patching Mixers

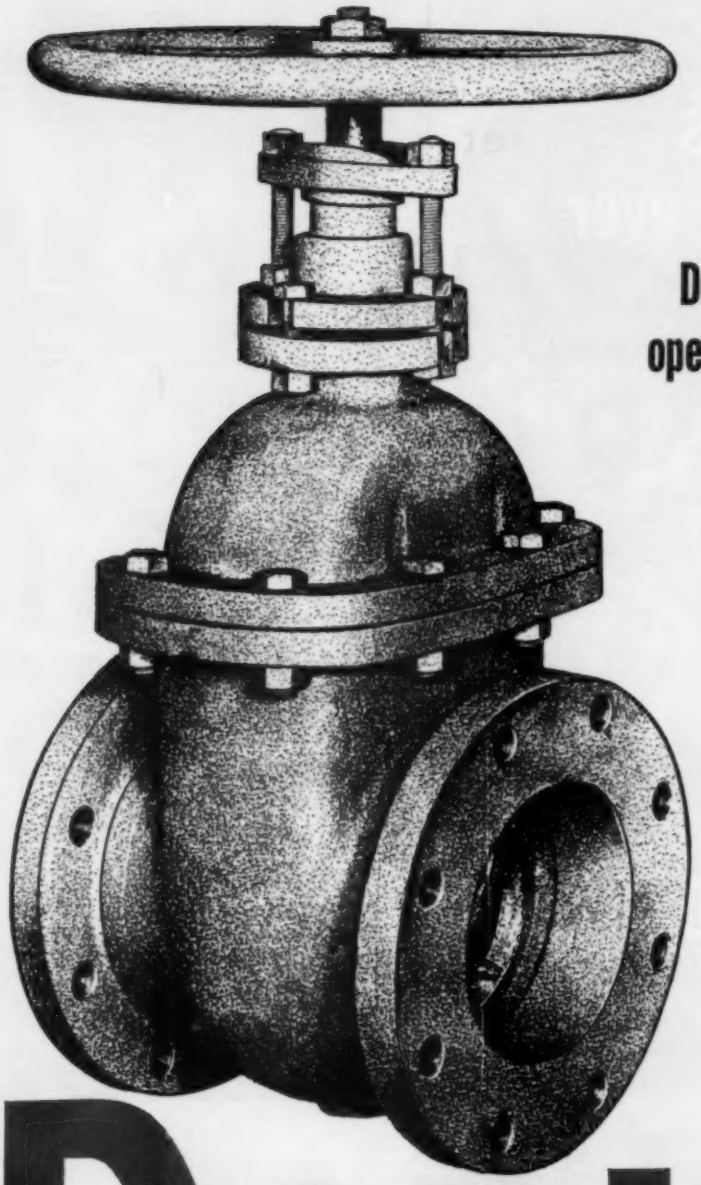
586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Versatile Crawler With Power and Controlability

707. Within this 24 page booklet (Form No. 607R) are liberally illustrated descriptions of the features of the Euclid C-6 for clearing, dozing, stripping, grading and a variety of other applications. Specifications covered. Circle reply card or write to Euclid Division of General Motors Corporation, Cleveland 17, Ohio.

100 HP Motor Grader

715. Model 330-H features a constant-mesh transmission, 8 forward and 4 reverse speeds, full-diesel rubber-mounted engine. With hydraulic brakes, ample strength and weight, and a wide range of blade adjustments. Write for bulletin (Form No. M6-174) from LeTourneau-Westinghouse Company, Peoria, Illinois, or circle reply card.



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Gate discs are independently hung and free to revolve. They change their seating position at each closing. All working parts are perfectly plain. There are no pockets to collect sediment or prevent free and easy movement.

For assured ease of operation, minimum maintenance, long trouble-free service life, *you can depend on Darling*. Our engineers are always glad to assist you in determining the right valves for your service conditions. Darling Catalog No. 57 gives complete specifications. Write for your copy today.

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Now... pipe repairs are easier than ever

with the Dresser® 360® Clamp!

Dresser "360" repairs steel, cast iron or A-C pipe. One-side wrenching lets bolts be tightened from easiest position.

Drop-in bolts mean fast, easy assembly, no loose parts. Simply spring clamp around pipe, drop in bolt heads and tighten nuts.

The "360" holds pipe bottle-tight, even when deflected as much as 5°. Also, it is not troubled by misalignment up to ⅛".

Nothing beats the speed and ease of repairs with the Dresser "360" All-Around Repair Clamp! With its drop-in bolts, there's no nut removal, no loose parts in the ditch...one set of lugs means bolting where it's easy. The gasket—a thick, smooth, butt-joined blanket has 65% more rubber for absolute sealing. Doesn't wrinkle. The Dresser "360" provides ⅜" adjustment—fits more pipe sizes, means fewer clamps to stock. For details on the "360", or any of THE DRESSER LINE for coupling or repairing pipe — write us, or call your nearest Dresser Distributor.

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SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Electric Submersible Pumps

75. Beautiful new full-color illustrated booklet describes most of the pumps in the FLYGT line. Just ask for "Black Magic" brochure from Flygt Corp., Hoosick Falls, N. Y., or use our reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Sewer Pipe Joint Sealing Compounds

104. Hot poured or cold applied, fully described in workmanlike file that gives specifications and prices. For your useful copy address Allied Materials Corporation, P. O. Box 7278 39th Street Station, Oklahoma City, Oklahoma, or use our handy reply card.

What You Should Know About Venturi Tubes and Nozzles

105. Bulletin No. 100 contains a short description of the various types of Venturi tubes used for water, sewage or sludge service. This is a condensed bulletin which should be in the files of all consulting and designing engineers involved in water and sewage works design. Write Simplex Valve and Meter Co., 7 East Orange St., Lancaster, Pa. or check the reply card.

Packaged Underground Lift Station

124. Selection tables and detailed drawings of packaged underground lift stations with "Fluat Kleen" sewage pumps are available in literature from Chicago Pump Co., 622 Diversey Parkway, Chicago 4, Ill. Check the reply card today.

Stationary Diesels For Water and Sewage Plants

167. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #115A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

Package Sewage Plants for 50—5000 Population

181. Design information on Walker "Sparjair" package sewage treatment plants for sizes from 50 to 5000 population equivalent is presented in a 12-page bulletin, No. 19-S-94. Typical plans and sections, special design considerations, specifications and a discussion of the "how" and "why" of the contact stabilization process are included. Check the inquiry card or write Walker Process Equipment, Inc., 840 No. Russell, Aurora, Ill.

Guide Book Information for Emergency Power

153. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

Rubber Joints for All Types of Concrete Pipe

265. . . . are described and their advantages outlined in a new Engineering Manual which engineers in particular, will find valuable with respect to physical properties and performance characteristics of rubber compounds used in such joints. Plenty of on-the-job illustrations of value to contractors and all pipelayers. Address Hamilton Kent Mfg. Co., 427 W. Grant St., Kent, Ohio, or check our card number.

How to Save $264 per Mile

216. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how such savings can be accomplished. It costs nothing to find out and it may be your best investment of the day. Write for it to Flexible, Inc., 415 South Zanga Blvd., Dallas 8, Texas, or circle the card number herewith.

Gratings for Sewage, Water and Lighting Plants

217. Aluminum or welded steel gratings and treads, according to your needs, are well described and illustrated in literature to help you design, specify and select. Write for file No. AIA 14-R to Grating Division, Rockwell-Standard Corporation, 4000 East 7th Avenue, Gary, Indiana, or check the inquiry card today.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 427 West Randolph St., Chicago 6, Illinois.

Bulletin on Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Diesel Engines For Municipal Power Needs

339. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., P.O. Box 2161, 550 85th Ave., Oakland 21, Calif.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

You are not Seeing Double

688. The Weil submersible sewage and sump pumps actually offer a choice of two motors, two controls. MICRO switch controls start and stop pumps, alternate pumps, and to provide high water alarm. Get Booklet SE-860 for complete engineering information from Weil Pump Co., 1526A N. Fremont St., Chicago 22, Ill., or circle card number.

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WEDGE-LOCK*
ASTM C 425 - 58T Type I

WEDGE-LOCK TYPE "O"
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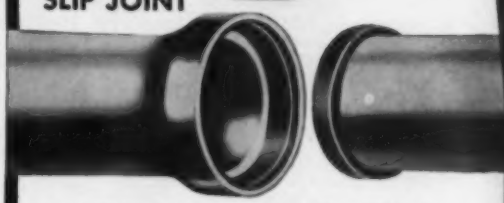

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And Evans DoubLength Clay Pipe cuts laying time, saves jointing labor. It's an all-new product — longer, stronger, with the *best* joints, and a new 100-year guarantee!

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General Offices: Uhrichsville, Ohio
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E-261-65

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standard working pressures

fire hydrant metering

heavy-duty (250 lbs. working pressure)

installation in existing pipelines

measurement of open channel or submerged pipeline flows

Send for Bulletin MR-105 describing our complete line

Badger Meter Mfg. Company

Measure-Rite Division

536 North Vincent — Covina, California
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Motors, Generators and Controls

266. 12-page illustrated brochure concentrates on slow speed synchronous motors, 20 to 10,000 hp. Gives full data, specifications, application and cities typical installations. Write for Bulletin 502 to The Ideal Electric Mfg. Co., Mansfield, Ohio, or use our card.

Wedge-Lock "O" Ring Joints for Vitrified Clay Pipe

482. Joints for large diameter pipe, using the Wedge-Lock principle of factory made joints plus a rubber "O" ring for compression sealing, described in 4-page folder of Evans Pipe Co., Uhrichsville, Ohio. Check reply card for your copy.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., Division—Union Tank Car Co., Lenexa, Kansas for design notes, charts and drawings.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Reinforced Plastic Pipe and Fittings

549. . . . . for water and sewage service, in sizes 2 through 8 inches, made of epoxy resins and glass, highly resistant to hydrogen sulfide gas, electrolysis and difficult soil conditions. Booklet tells all in 16 illustrated pages. For your copy write Amercoat Corporation, 4809 Firestone Blvd., South Gate, Calif., or circle number on the card.

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

Kohler Standy-by Units Protection Against Power Failures

602. Dependable Kohler electric plants provide uninterrupted power for vital services when regular sources fail. Kohler Electric Plants World-Wide, folder E-402, illustrates models available for stand-by, sole supply, portable and marine applications. Sizes from 500 watt to 115 kw, gasoline, gas or Diesel operation. Write Kohler Co., Kohler, Wisconsin, or use the reply card.

Play Safe with Automatic Controls

603. Remote engine and pumping controls of every sort are fully described in a series of bulletins offered by Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Write them or circle the above number on our card.

Reinforced Concrete Pipe For Culverts and Sewers

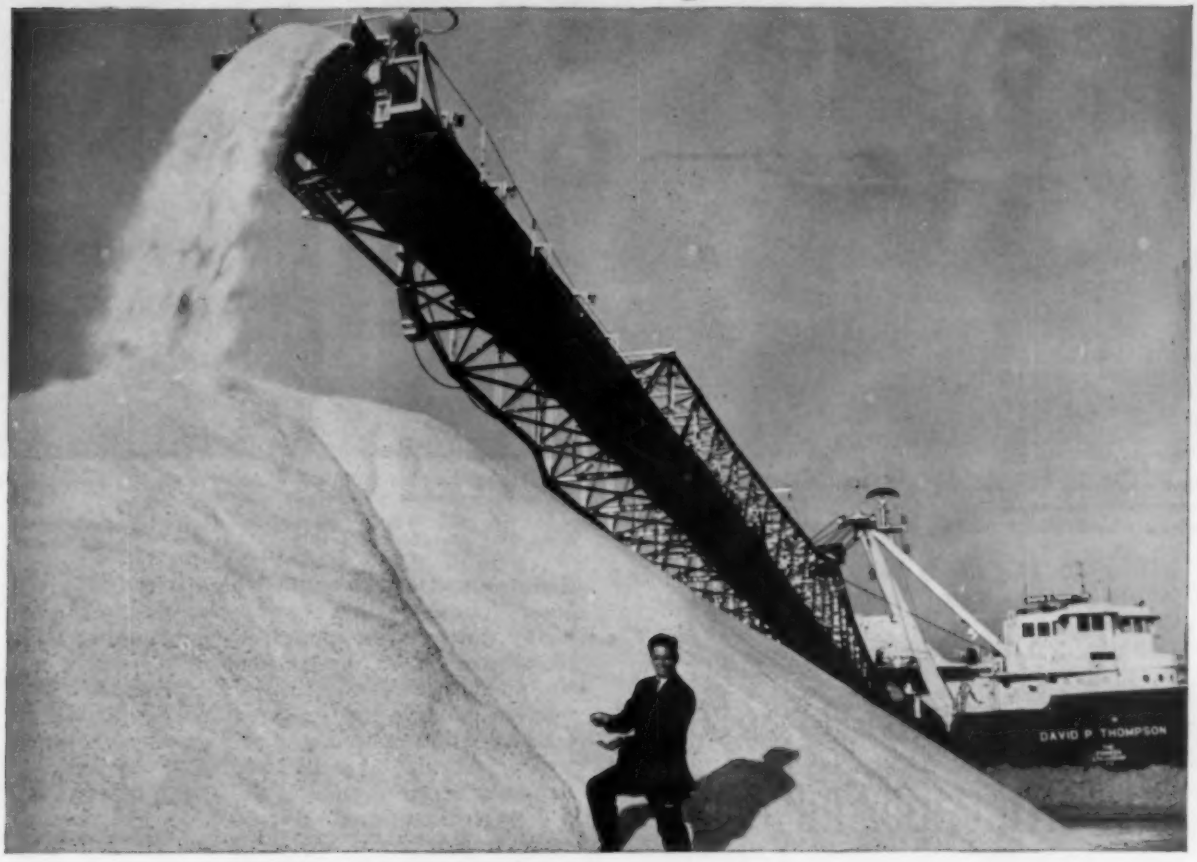
672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Sewage Plants for Small Communities

674. "Total Oxidation" type sewage plants give economical BOD removal, and serve communities of 75 to 3,000 people. The Accelo-Biox plant uses either atmospheric or compressed air. Description in Bulletin 6520. Write Infilco Inc., P. O. Box 5033, Tucson, Arizona, or check reply cord.

(More listings on page 52)

BEHIND THE MAN FROM DIAMOND CRYSTAL SALT...
the snow & ice removal experience of Blake Jordan!



Blake Jordan, Manager, Rock Salt Sales—Highway Division, Diamond Crystal Salt Company, is a fine example of home office assistance given the "Man from Diamond Crystal". On-the-spot experience and the understanding of problems by home office officials, helps Diamond Crystal salesmen serve your needs more efficiently.

Pictured above is Blake, supervising the unloading of Rock Salt for snow and ice removal onto a new storage depot at Buffalo, New York. In addition to the Buffalo depot, Diamond Crystal Salt Company has opened other strategically located Rock Salt Storage Depots throughout the snow and ice belt. These new depots can help you maintain maximum safety precautions by supplying all your salt for snow and ice removal . . . fast and economically.

Here are the locations:

Buffalo, New York
Charleston, West Va.
Chicago, Illinois
Cincinnati, Ohio
Cleveland, Ohio
Detroit, Michigan
East Liverpool, Ohio
Green Bay, Wisconsin
Holland, Michigan
Louisville, Kentucky
Marietta, Ohio
Milwaukee, Wisconsin
Port Huron, Michigan
St. Clair, Michigan
Minneapolis, Minn.
Prairie du Chien, Wis.
Davenport, Iowa
La Salle, Illinois
Michigan City, Indiana
St. Louis, Missouri
Omaha, Nebraska

Learn exactly what these new storage depots can mean to you for fast, economical service. Call or write the nearest Diamond Crystal sales office.

T.M.

Diamond Crystal Salt Company
ST. CLAIR, MICHIGAN

75th Anniversary 1886–1961

PLANTS: AKRON, OHIO; JEFFERSON ISLAND, LA.; ST. CLAIR, MICH.
SALES OFFICES: AKRON • ATLANTA • BOSTON • CHARLOTTE • CHICAGO
DETROIT • LOUISVILLE • MINNEAPOLIS • NEW ORLEANS • NEW YORK

Mow anything from fine turf to thick brush with International Danco rotary mowers. Cutting widths of 42, 58, 60, 72, and 94 inches are available for matching International tractors.

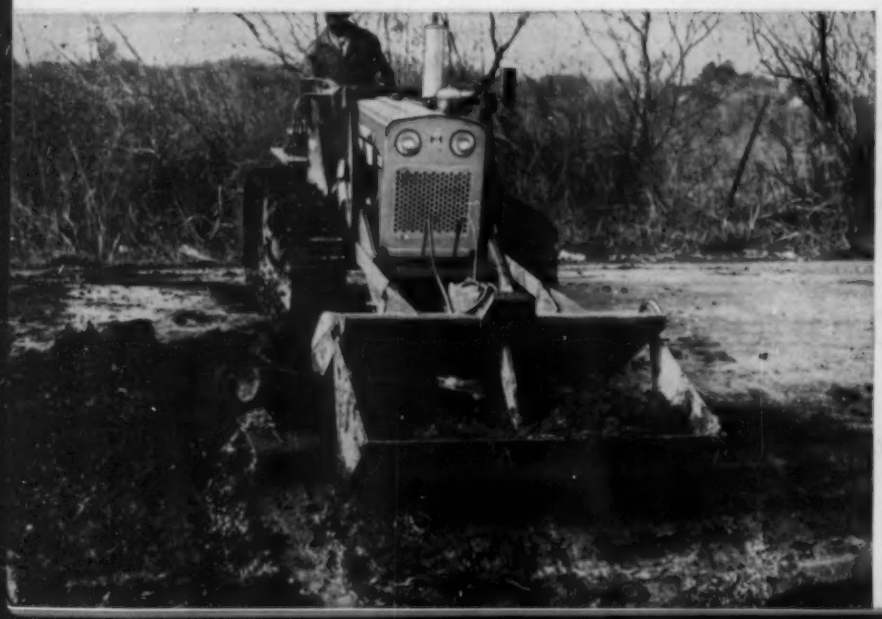
From mowing to towing...

International® tractor stamina makes tax dollars go farther

Greater built-in strength where it counts gives International tractors the stamina to stand up in heavy duty service long after more lightly built units have had it. Perfect mating of tractors and equipment assures you the working speed and production ability you need to make budgets go farther. Your operators can keep International tractors working at peak capacity all day long . . . handle a bigger volume of work with fewer units.

Only International offers such a wide range of wheel tractor power sizes—allowing you to power-match your jobs and thus trim costs still farther. Trouble-free operation lowers maintenance costs, reduces your parts stock requirements. Fuel economy is outstanding.

The amazing International Drott T-340 Four-in-one combines ¾-yard bucket with bulldozer, scraper, and clamshell. Operator changes from one tool to another on-the-go.



Match trenching needs with a rugged International Wagner backhoe. Three models, 10, 12½, and 13¼-ft. digging depths, are unit-engineered for four corresponding tractor sizes.

Cut a 10-foot swath with a 60-inch International rotary cutter and International balanced-head mower with five-foot cutter bar, on International tractors.

The IH dealer near you will be glad to give full information—demonstrate if you wish. See for yourself the quality of construction that means minimum downtime, reduced maintenance, longer life!

INTERNATIONAL TRACTORS—Condensed Specifications

Tractor Model	No. Cyl.	Displacement, cu. in.			Maximum Engine Hp*			Drawbar Horsepower*			Speeds	
		Gas	Diesel	LPG	Gas	Diesel	LPG	Gas	Diesel	LPG	Standard	Torque Amplifier
Cub® Cadet®	1	16.2	—	—	7	—	—	NA	—	—	3	—
Cub Lo-Boy®	4	59.5	—	—	13.4	—	—	10	—	—	3	—
140	4	123	—	—	28	—	—	22.1	—	—	4	—
275	4	—	144	—	—	38	—	—	30.9	—	8	—
240	4	123	—	—	40	—	—	28.9	—	—	4	—
340	4	135	166	—	47	47	—	32.4	36.9	—	5ƒ	10
T-340 Crawler	4	135	166	—	47	47	—	31	33.8	—	5ƒ	10
460	6	221	236	221	61	61	61	48.1	48.1	46.9	5ƒ	10
560	6	263	282	263	72.5	72.5	72.5	59.4	58.6	58	5	10
660	6	263	282	263	95	95	95	73.2	74.3	73.2	5	10

*Corrected to standard conditions.
ƒAvailable with Fast-Reverser—gives five reverse speeds.

INTERNATIONAL HARVESTER

International Wagner loaders—nationally known for capacity and durability—are unit engineered for all International industrial tractors—capacities, 650 to 4,000 lb.

Cut costs, handle drawbar work more efficiently with heavy-duty International wheel tractors. Bigger, more costly power can work more productively on earthmoving projects.

Principles of SOIL ENGINEERING

By Robert F. Baker

SOIL engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition, or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs to assist the engineer in his work.

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STREET PATCHER
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5 TON COMPACTION WATER-TIGHT SEAL

OVER 300 CITIES REPORT,
"Hot Roll is the major advancement
in recent years for asphalt street repair".

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BUSINESS ADMINISTRATION

Save Space By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

If You are Considering a trustee for a Bond Issue Check with Chase Manhattan

236. For details on how a bank serves as trustee for bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15, N. Y.

Stop Waste in Hand Washing

497. Quick cleanup after the job with a saving of soap and your employees' time is easy with Gojer hand cleaner and dispensers. You'll find it pays you, too. Get details from Gojer, Inc., Box 991, Akron 9, Ohio.

REFUSE COLLECTION AND DISPOSAL

Where Does It Go From Here?

63. That is the title of new 12-page booklet, D 930, with thorough discussion of garbage disposal by sanitary landfill method. Read the latest report from the experts. Caterpillar Tractor Co., Peoria, Ill., or check card.

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems

Data on the Hydro E-Z Pack Refuse Collection

572. This disposal body has no moving chains, no whirling knives, and has a 76,600 lb. pressure that takes anything and compacts everything. Check the reply card or write Hydro E-Z Pack, Div. of Hercules Galion Products, Inc., Galion, Ohio, for a copy of Bulletin EZ-100.

STREET LIGHTING AND TRAFFIC CONTROL

Much Cheaper than Cops . . .

31. is good street lighting in preventing crime. To guide you to better lighting there is a new Kerrigan booklet. "A Bright City is a Safe City." Describes full line of lighting standards, also how to promote better lighting in your city and county. Address, Lighting Standard Div., Kerrigan Iron Works Co., 1033 Herman St., Nashville, Tenn. or use our card.

Aluminum Traffic Control Devices

32. Is title of 24-page booklet covering every such device made of aluminum, from signs and sign blanks to panels, overhead structures and paint. Full specifications. For yours, just write Aluminum Co. of America, Alcoa Bldg., Pittsburgh 19, Pa., or use reply card.

Complete Catalog on Traffic Control Equipment

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 14, Kans.

For Better Pavement Striping

626. You will not want to be without this 38-page deluxe booklet that does not stint on giving you invaluable aids to better, faster striping operations. Includes descriptions of every pertinent tool and piece of equipment. Ask for Catalog W-58 from Wald Industries, Inc., Huntingdon, Penna., or use our card.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Ice Control Without Corrosion Dangers

164. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Center., Pittsburgh 30, Pa.

Save on Winter Ice Control Cost

237. . . . with the faster-working salt described in this new Bulletin B-1159S. Tells what this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects. Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our card.

Snow Plows For Every Need

294. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N.Y.

Hydraulic Controls Make Snow Plowing Easier

368. Hydraulically operated power controls may be readily installed on trucks that will plow snow this winter. Start preparing now to make winter maintenance an easier job. Get illustrated folder from Monarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Use the inquiry card.

All-Weather Spreader for Standard Dump Trucks

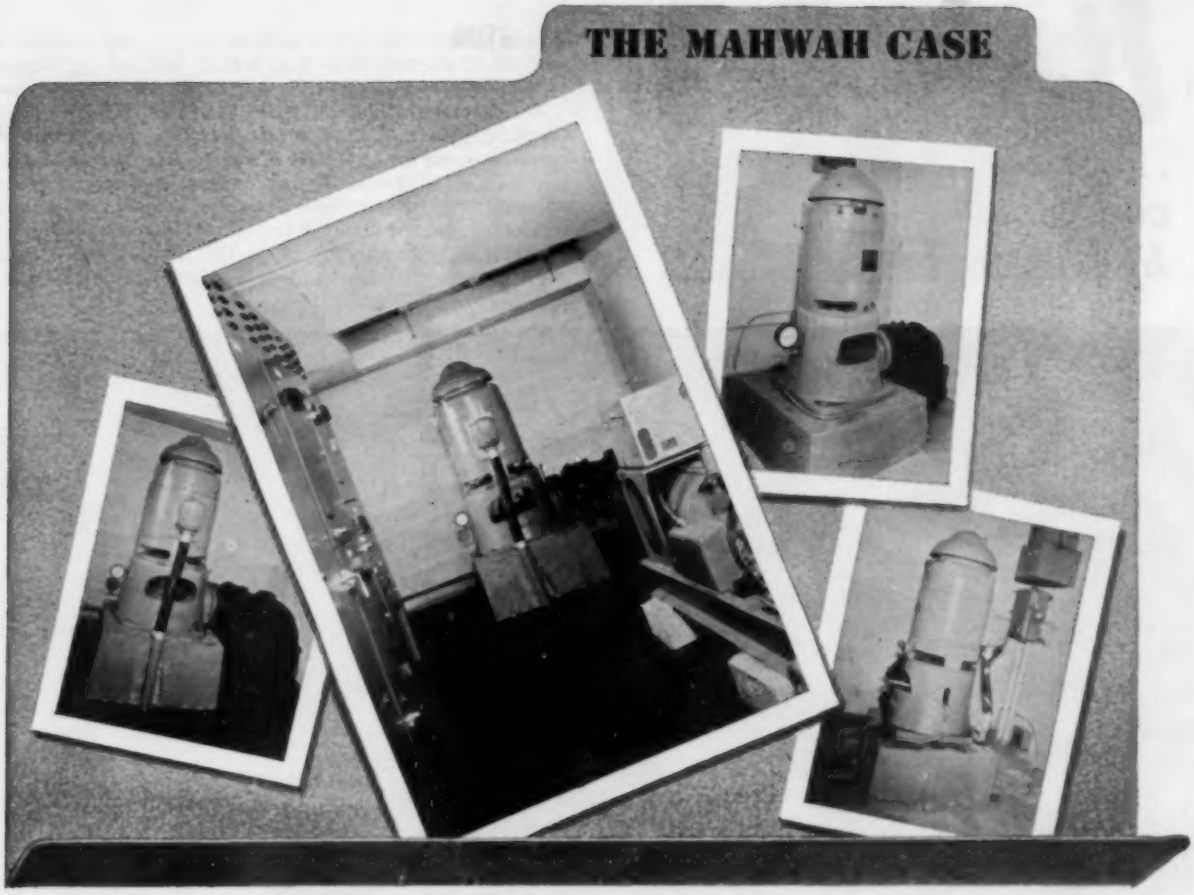
472. Get data on the new "Rollgate" hydraulically driven roll-type spreader that applies uniform amounts of salt, sand, cinders or other materials up to 1 inch diameter over an 8-ft. width. Write Good Roads Machinery Corp., Minerva, Ohio, or check the inquiry card.

Formulation for use in Thermal Snow and Ice Removal Systems

493. The properties and advantages of Dowtherm SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from The Dow Chemical Co., Midland, Mich.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.



DEMING TURBINES at work . . . 4
Total years on the job 28
Maintenance required 0

Consider this when you begin planning expansion or replacement of your pumping facilities:—Four DEMING Turbine Pumps at the modern public water works of Mahwah, New Jersey, have been on the job steadily since 1953—without a single service need.

Rated pump capacities: 1400 G.P.M., 600 G.P.M., and two at 800 G.P.M. Drive: electric motor; with diesel auxiliary for the 125 h.p., 1400 G.P.M. pump. Discharge pressure: 80 pounds. Pumping level in wells: 100 feet from surface.

Simple design—low maintenance

Widely known for their simplicity of design, and engineered to handle both emergency and normal demands smoothly, DEMING Turbine Pumps have established an enviable record of low maintenance cost.

What are **your** specifications? DEMING Turbine Pumps will meet them. Write for Bulletin 4700 and the location of the DEMING installation nearest you. Address—

DEMING
DIVISION CRANE CO.
1093 Broadway • Salem, Ohio

MAINTENANCE RECORD—DEMING PUMPS				
Year	Pump #1	Pump #2	Pump #3	Pump #4
1953	none	none	none	none
1954	none	none	none	none
1955	none	none	none	none
1956	none	none	none	none
1957	none	none	none	none
1958	none	none	none	none
1959	none	none	none	none
1960	none	none	none	none

Please send me full information on the complete line of DEMING pumps for municipal service.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

It moves

. . . powered and controlled by Westinghouse

Press a button—an indoor auditorium becomes an open air stadium in 2½ minutes—and behind that button is an unparalleled story of engineering and construction cooperation.

Architectural and engineering teamwork has given Pittsburgh the world's first movable roof auditorium. This versatile structure adds to the city's renaissance, in one building, a 14,000 seat sports arena, a convention hall, open air amphitheater, and an exhibit center. Westinghouse products bring the facilities to life, give precision control for the delicate manipulation of six 300-ton movable leaves.

Outwardly, the new auditorium is a 400′ stainless steel

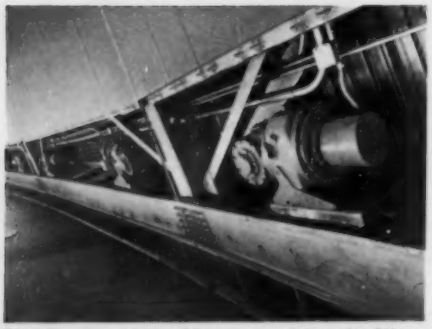
J-94176-1

umbrella, suspended from a space frame cantilevered from the ground. That is one outstanding construction teamwork story.

Inside, coordination culminates in a control console located high above the seating area. From this station the

J-94176.2

Construction Motivators: The Authority & Industry
l to r seated: Judge A. L. Wolk, Vice Chmn.; N. Stabile, Sec'ry Treas.; W. B. McFall, Chairman; H. R. Edelman, Jr., Pres. Heyl & Patterson; and D. J. McDonald, Vice Chmn.
standing: C. B. Jansen, Member; J. E. Payne, V. P. Westinghouse; and Edw. Fraher, Exec. Director



The six movable roof leaves are driven by Westinghouse right angle gearmotors, five to each leaf. Photo shows base of one of the movable leaves with the acoustic ceiling panels removed.

O. M. Newman, Heyl & Patterson, and Edward Cohen, Ammann & Whitney, discuss roof electrical drive with C. G. Falkenstein, Westinghouse, kneeling in front of main roof reactor control cabinet.

unique movable roof drive system is activated. An AC reactor control scheme keeps all six movable leaves in step throughout open and close cycles. Each leaf is driven by Westinghouse Moduline® gearmotors, with opposite leaves being operated in pairs.

Close cooperation among architects, engineers, owner, contractors and Westinghouse helped to provide a system flexible enough to serve varying building demands, with the high degree of electrical reliability required.

For more complete information on the electrical aspects of construction, write to: Westinghouse, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94176-3

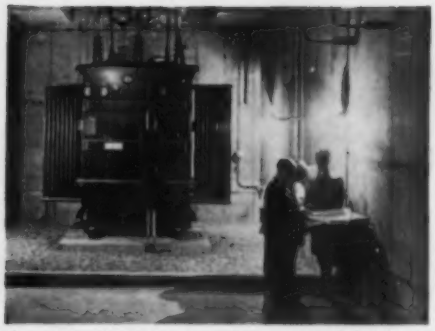
5KV metal-clad switchgear contains a tie-breaker to provide emergency switching between two incoming 4160-V lines. Seen here: N. J. Grady, V. P., Ernst, C. J. Long, and A. B. Janaszek.

Checking construction progress are C. J. Long and F. J. Sarknas, Westinghouse. In background, 1500 kva power center supplies power for building auxiliary and air conditioning compressor motors.

Westinghouse Motor Control Center located in the Mechanical Room centralizes auxiliary motor controls. Discussing installation advantages are H. R. Helvenston, C. J. Long and N. J. Grady.

Three 125 hp Lifeline A motors drive freon compressors to chill brine supply for ice rink piping. Seen here are P. F. Schad, Limbach, and C. G. Falkenstein, Westinghouse.

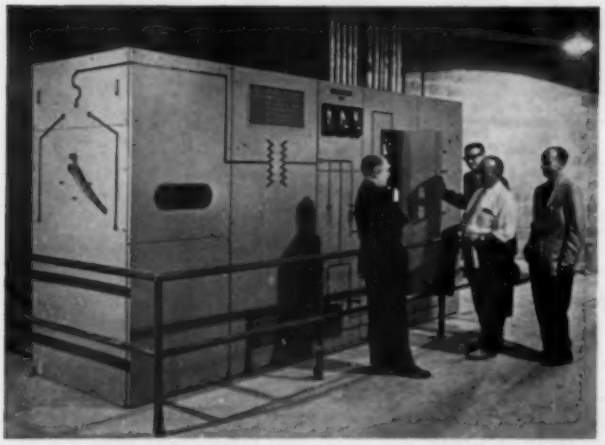
Operator's view from roof control console high above the spectator area. Visible through the glass front is the juncture of the first two movable leaves of the roof.



One of main power transformers rated 2500 kva at 11.6 kv to 4160 volts. Discussing the power supply are C. J. Long, Electrical Engineer, M. A. Geffel, Ernst, and A. B. Janaszek, Westinghouse.

Builder: Public Auditorium Authority of Pittsburgh & Allegheny County: *Resident Engineer & Supt. of Construction:* H. Rey Helvenston
Architects: Mitchell & Ritchey, Pittsburgh
Roof Designers & Engineers: Ammann & Whitney, N.Y.
Electrical Engineer: Carl J. Long & Associates, Pittsburgh
Mechanical Engineer: John Mullin & Associates, Pittsburgh
General Contractor: Dick Corporation, Large, Pa.
Electrical Contractor: E. C. Ernst, Inc., Pittsburgh
Mechanical Contractor: Limbach Company, Pittsburgh
Drive System Contractor: Heyl & Patterson, Inc., Pittsburgh

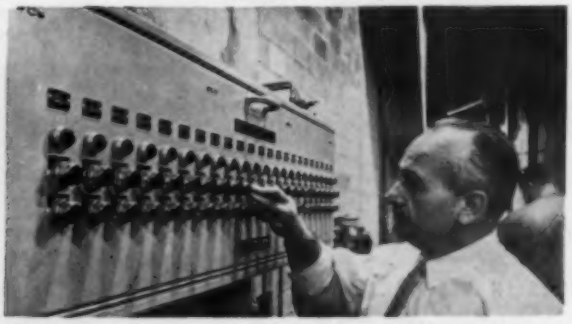
Westinghouse



Another Westinghouse power center, this 300 kva ASL dry type supplies lighting and auxiliary power. Discussing its component parts are C. J. Long, A. B. Janaszek, M. A. Geffel and Albert Simon, Ernst.

Type M Electric Stairway transports 8,000 persons /hr. Top to bottom: E. R. Gallagher, supervising architect; H. R. Helvenston, resident engineer; and A. Simmonds, Westinghouse Elevator.

Fan room equipped with series 8000 Air-Foil centrifugal fan and air conditioning coils. W. Y. Humphreys, Westinghouse, with John Mullin, Consulting Engineer, air conditioning and ventilation system designer.



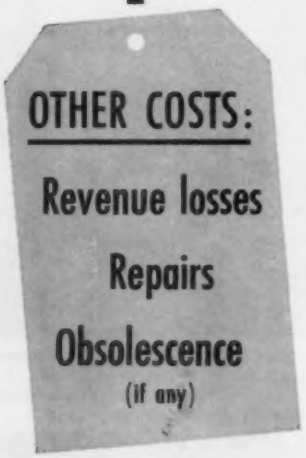
Westinghouse mercury vapor parking area and floodlighting are operated from this remote control panel located in the mechanical room. M. A. Geffel, Ernst, tests lighting circuits.

J-94176-4

When you open the water meter bids...

ADD UP THE TRUE TOTAL

+



New Trident
Model 60
Sealed Meter

THEN make the best buy...

A water meter should be a lifetime purchase. Its price tag gives only *part* of its cost. Look instead for *true annual costs:*

First, think of revenue loss. A meter returns 12 to 20 times its price before its first check-up. A slight slip in accuracy loses more money than you "save" in a low bid.

Secondly, meters must be tested regularly. One that checks OK *without* repairs obviously is worth more. In the long run, the meter that is *easiest* to repair is also worth more.

Finally, with most meters you must add obsolescence. But not with Trident. A Trident constantly modernizes itself. All design improvements are made to fit older Tridents too; you get them *automatically* as you insert replacement parts.

Trident meters are designed not for low bid but for low true annual cost. That's why Trident is always your "best buy."

Ask your Neptune representative.

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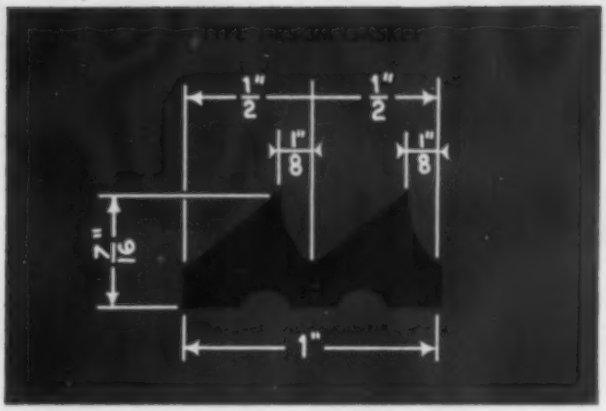
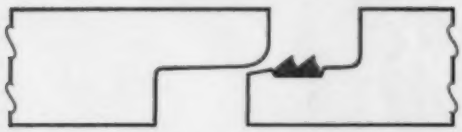
TWO-WEDGE PRESS-SEAL

GASKET...*makes* TWO-WAY SEAL *in recessed concrete sewer pipe*



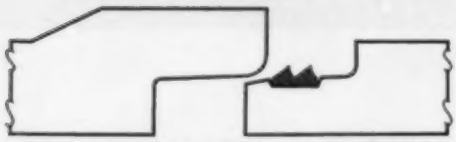
BELL AND SPIGOT PIPE



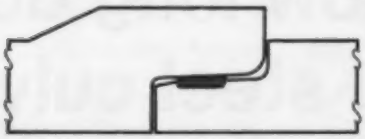
Gasket properly positioned in recess

Gasket depressed to fill annular space

TONGUE AND GROOVE PIPE



Gasket properly positioned in recess



Gasket depressed to fill annular space

Two wedge shaped sections, joined into one integral base, provide a double seal effect with the Press-Seal Type 1-RS-3M molded gasket. Designed to be used in conjunction with a recess in the tongue or spigot end of concrete pipe.

When assembled, resilient rubber depresses to fill annular recess space. Each gasket is cut to a precalculated and determined volume to assure a watertight joint. Confinement of gasket by sides of annular recess makes a positive seal against exfiltration or infiltration. Will withstand head pressures up to 50 feet.

This gasket design and the resilience of the rubber permit angular deflection and shear loads to be imposed without affecting the sealing action.

Press-Seal Type 1-RS-3M molded gaskets available in Natural and Styrene-Butadiene rubber for common sewage, Neoprene for animal fat and acid content, Buna-N for oil content.

Can be applied either at pipe manufacturer's plant or job site.

Write for our manual No. 4—Better seals for concrete pipe.

The lowest cost material item in any Pipe-line Project is a PRESS-SEAL Gasket

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FORT WAYNE, INDIANA • Phone Kenmore 5213
TRADE
MARK

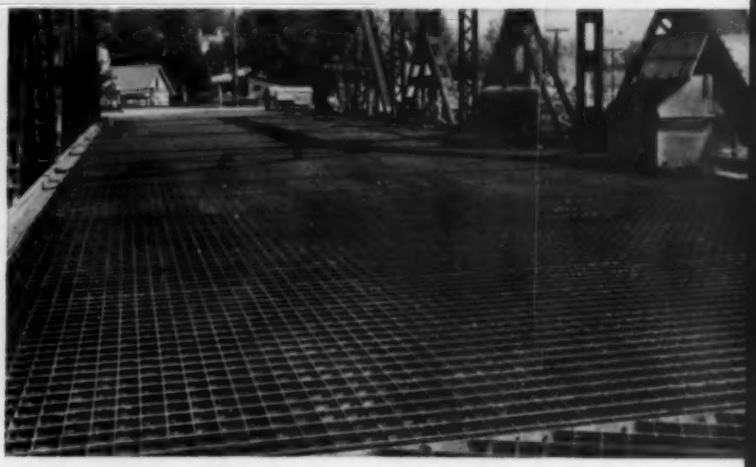
PRESS-SEAL GASKET OF CALIFORNIA—P.O. BOX 3054, SANTA BARBARA, CALIFORNIA
PRESS-SEAL GASKET OF CANADA—KITCHENER, ONTARIO

How long does a steel culvert last?

This mark tells you a product is made of modern, dependable Steel.

USS AMBRIDGE HIGHWAY BEAM GUARDRAIL AND POSTS HELP SAFEGUARD TRAFFIC. This rugged, flexible steel beam guardrail is highly visible. It bolts easily and firmly to posts and is available in 25' lengths to minimize splicing. Send for folder.

TRIM DEAD WEIGHT FROM OLD BRIDGES with strong, lightweight USS AmBridge I-Beam-Lok bridge flooring. Superior strength-to-weight ratio permits fast re-flooring without costly renovation of superstructure. Ideal for use on long spans, where weight is a vital factor. Send for book.



This eight-foot-diameter culvert was unearthed during a road widening project near Red Lake, Arizona. It had been buried under the roadway for about thirty years! When extension pieces were bolted on to make it longer, it was hard to tell the old from the new. Long life is only part of the USS AmBridge Sectional Plate story. The story begins with remarkably simple installation. Just smooth the grade line, set the sheets into place, bolt, and backfill. No need to build forms or sit out costly curing time. American Bridge has a new booklet about USS AmBridge Sectional Plate. Write for your free copy. General Offices: 525 William Penn Place, Pittsburgh 30, Pennsylvania. USS, I-Beam-Lok and AmBridge are registered trademarks

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American Bridge Division of United States Steel

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PRECISION AND SKILL

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Close-up view of an IRVICO pressure-locked aluminum grating carefully engineered to fit precisely around pipes and valves in a modern water-pumping station.

★

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When you specify IRVICO grating, you receive the benefit of engineering and manufacturing skill developed during more than 57 years of experience in the production of grating. Each IRVICO order is given careful engineering attention. Experienced shop craftsmen execute your order with finesse, and our inspectors permit no grating to be shipped unless it meets your specifications and our high standards. This insures high quality grating, an excellent fit, and no extra installation costs. Catalog on request

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Public Highway by Use

Bino v. City of Hurley, 109 N. W. 2d 544, a Wisconsin case decided June 6, 1961, was an action by property owners against the city for removal of a gate from the owner's land and to enjoin the city from dismantling or removing any replacement gate which the owners might erect across a certain private roadway located on their premises.

The roadway in question extends from highway 51 to the city water pumping station located near the shore of the lake, the length of the same being slightly in excess of one-third of a mile. A spur branches off part way to the pumping station, which spur leads to the lakeshore. Such roadway has been in existence since 1890.

From 1890 to 1924 the roadway was used by people who wished to make use of the lake and adjacent shore for picnics, bathing, boating, and fishing. After 1900 the owners used such roadway in hauling ice which had been cut from the lake during the wintertime. Up until 1924 the only building located on the lands now owned by the plaintiffs was an ice house.

In 1924 or 1925 a predecessor in title to the plaintiffs conveyed two acres of land to a water utility company which erected a water pumping plant thereon in order to pump water from Lake Lavina with which to supply the defendant city. According to the records in the office of the Public Service Commission the city took over the direct operation of such water utility in 1935, and thereafter has continued to operate it. During such time the city has graded the roadway leading to the pumping station, has removed brush from the sides thereof, and has plowed snow therefrom during the wintertime. The spur was not included in such operation.

Since 1936 the lands owned by the plaintiffs have been inclosed by fences, and also since 1936 at various times cables and gates have been placed across this roadway at different points for the purpose of keeping horses from straying off the premises. In 1939 the plaintiffs erected a gate at the entrance of the roadway at highway 51, which gate remained in place for several years when it was accidentally damaged. The city replaced it with a gate which remained in place until 1949. In 1958 the plaintiffs erected another gate at this same location. It was the removal of such gate by the city which precipitated the instant action.

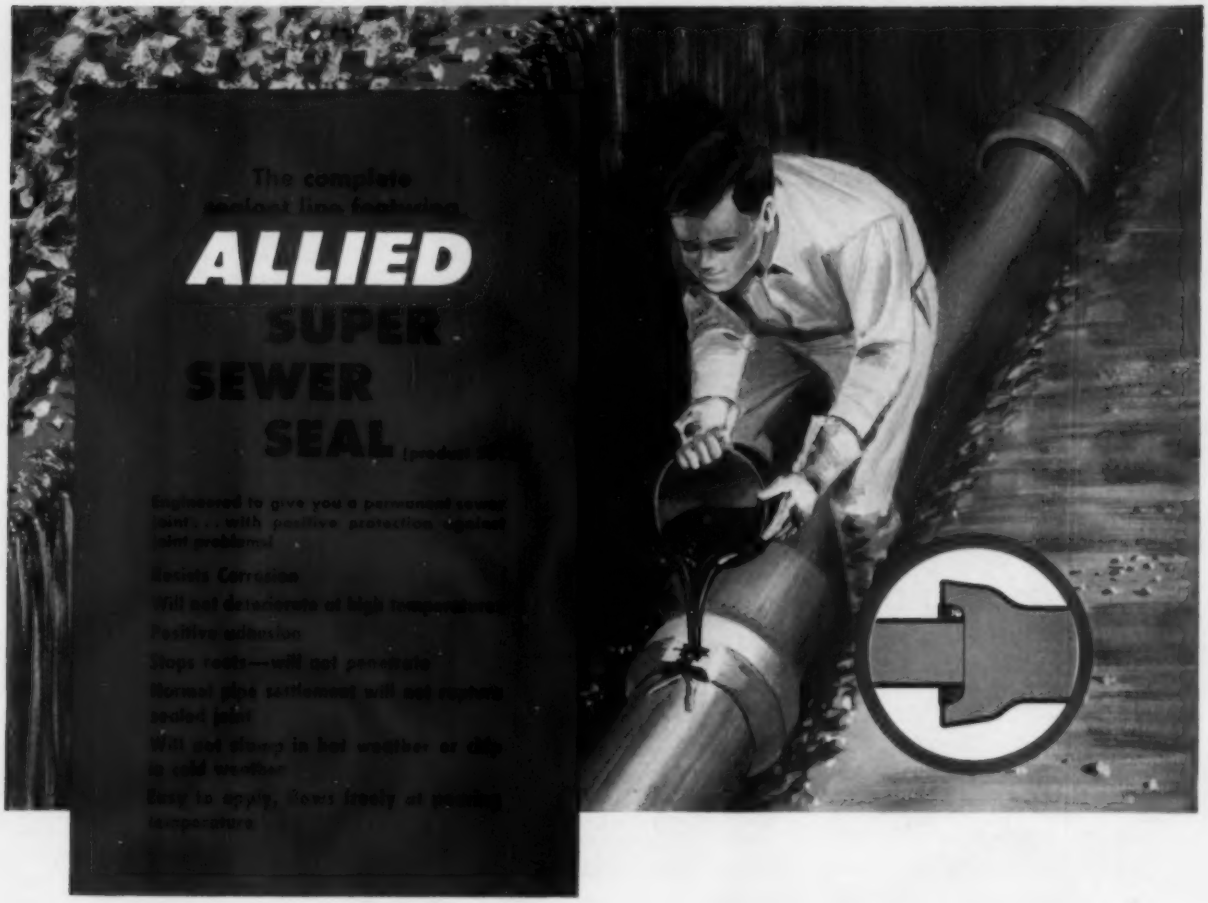
The Supreme Court of Wisconsin held that use by the public of the roadway to gain access to the lake for picnics, boating, bathing and fishing was not adverse and did not establish a public highway by user. It held further that the fact that picnic tables were erected on the shore of the lake and a boat livery was operated on the lake did not constitute improvements of such a nature as to prevent the use of such unenclosed, unimproved, and unoccupied land from being presumed to be permissive, rather than adverse.

Excavation in City Street

Elbert v. City of Saginaw, 109, N. W. 2d 879, a Michigan case decided June 29, 1961, was an action for personal injuries sustained by a child less than three years old who fell into a water-filled excavation made in a public street by the City.

The excavation, which was 4 feet deep, 4 feet wide, and 16 feet long, had been made by a construction company on behalf of the City, in connection with the laying of water mains. The excavation had remained open for 28 days, and had become filled with water to its brim.

The excavation was near an intersection in the street and 12 feet from the nearest point in the side-



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wa.k. It was across the street and a couple of houses removed from plaintiff's residence. It was surrounded by a long, sawhorse-type of wooden barrier on the street side; on the opposite side, between it and the sidewalk, by the pile of dirt, higher than the wooden barrier, which had been removed from the excavation, and at each end by boards laid across from the top of the wooden barrier to the top of the dirt pile. It was in a well developed residential area. Children passed it in going to a nearby school.

The child and his mother had been in their back yard where she was engaged in hanging up clothes. After a few minutes there, the child went into the house through the back door. The mother went into the house to look for him and, not locating him there, found him, according to her testimony, 5 to 6 minutes after he had left her, floating, head down, in the excavation. No one testified as to how or from what place he had fallen into it.

Artificial respiration was applied with the use of oxygen, for 45 minutes. The child recovered, but had suffered permanent brain damage.

One of the defenses asserted was the contributory negligence of the child's parents. From an adverse judgment, plaintiff appealed to the Supreme Court of Michigan. The latter court reversed and remanded for a new trial, on the ground that the contributory negligence of the parents was not a proper question to submit to the jury. It should have been held, on this point, that there was a legal duty to foresee such dangers and to exercise due care to prevent them from injuring persons such as the plaintiff. Whether or not this duty was breached will have to be determined by a new trial.

• • •

Nine Feet of Snow

The annual report of Gardiner, Maine, states that, in 1960, there were 105.7 inches of snow; and each inch of it cost $306 to remove. Total snow and ice control expenditures were $32,305. The cost to each taxpayer was $10; and for every $100 of tax money, $7.50 went for snow and ice fighting.

The Dogs Hold Their Own

The report of the Stratford Town, Conn., Dog Warden for 1960 shows 64 dogs killed by cars and 50 dogs injured, a total of 114. Dogs bit 113 persons during the same period, thus attaining a 50-50 break.

When it comes time to appoint a trustee or fiscal agent for revenue bonds, The Chase Manhattan Bank is at the service of state, county and municipal authorities. Chase Manhattan has the staff and experience to handle this function as trustee or fiscal agent in cooperation with banks in the areas where the projects are located. For complete details write: Corporate Trust Division, The Chase Manhattan Bank, 1 Chase Manhattan Plaza, New York 15.

No. 2 in a series of announcements on new HOUGH *machines*

This all-new 1¾ cu. yd. PAYLOADER

is far ahead

of any machine in its price class . . . in capacity, power, design and performance

The Frank G. Hough Co. has been engaged in a continuous program of research, development and improvement of exising models ever since it pioneered the first four-wheel-drive tractor-shovel. This program led to the new concept and design of the H-30 and H-120 PAYLOADER units which gained tremendous acceptance during the past two years and has helped to maintain PAYLOADER leadership.

The H-60 represents even further progress and development. It is a completely new machine in size and capacity with these special points of interest . . .

High Lift and Long Reach: Note the ease with which the operator deposits a full load in the hopper. Faster, more productive cycles are the result.

Safety and Convenience: All bucket and boom mechanisms are located ahead of the operator compartment for maximum protection. The steeply-sloped cowl and open design give 100% visibility. The comfortable, adjustable bucket seat and conveniently located controls make operation easy. The walk-in operator's compartment is easily accessible with safety ladder and hand rails.

Less Maintenance: Only PAYLOADER units like the new H-60 have a simplified boom mechanism with a single bucket tilt cylinder. This means you have from 4 to 10 fewer pivot and grease points and fewer parts to service and maintain. Furthermore, all pivot points on steering, boom and bucket mechanisms are fitted with "O" rings and other seals which keep grease in and dirt out to provide longer life and less maintenance. The hydraulic steering system uses two direct-acting rams with fewer pivot points.

"Keep-clean" Hydraulic System: A valuable, exclusive HOUGH feature is the closed and pressure-controlled hydraulic system to keep out air-borne dust and moisture. The new cylindrical, vessel-type reservoir has extra strength and the entire top is easily removed for thorough maintenance and easy servicing. There is a complete full-flow micronic filtering system.

"No stop" Full Power-shift Transmission: This HOUGH transmission was developed exclusively for rubber-tired tractor-shovel requirements and has been thoroughly proven on thousands of PAYLOADER units. All shifts, up or down, forward or reverse, can be made "on-the-go" with no stopping and engagement of gears needed for "range-shifts."

Sealed, 4-wheel Power Brakes: These powerful brakes are air-controlled with only touch-toe effort and are sealed against dust and dirt. Furthermore, the exclusive HOUGH axle design makes it possible to service and re-line the brakes without removing and exposing planetary hubs to dust and dirt. Another important HOUGH-pioneered feature is the "Operator's choice" dual brake pedals which permit braking with or without transmission engaged.

Positive Oil Cooling: Separate fan-cooled oil-to-air radiator assures positive cooling of both transmission and torque converter oil. Another exclusive HOUGH protective feature.

"Power-transfer" Differentials: Both axles are equipped with torque-porportioning differentials. When one wheel has better traction than the other on the same axle, it can automatically receive up to 38% more torque. This assures the best possible traction at all times.

The new H-60 model is offered with a choice of gasoline or diesel power and with buckets from 1⅛ to 3½ cubic yard capacities. (S.A.E. rated) For additional information and specifications, see your HOUGH Distributor or use the attached coupon.

THE FRANK G. HOUGH CO. 10-8-1
761 Sunnyside Ave., Libertyville, Ill.

Send full data on all-new Model H-60 "PAYLOADER"

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Title _____
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THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
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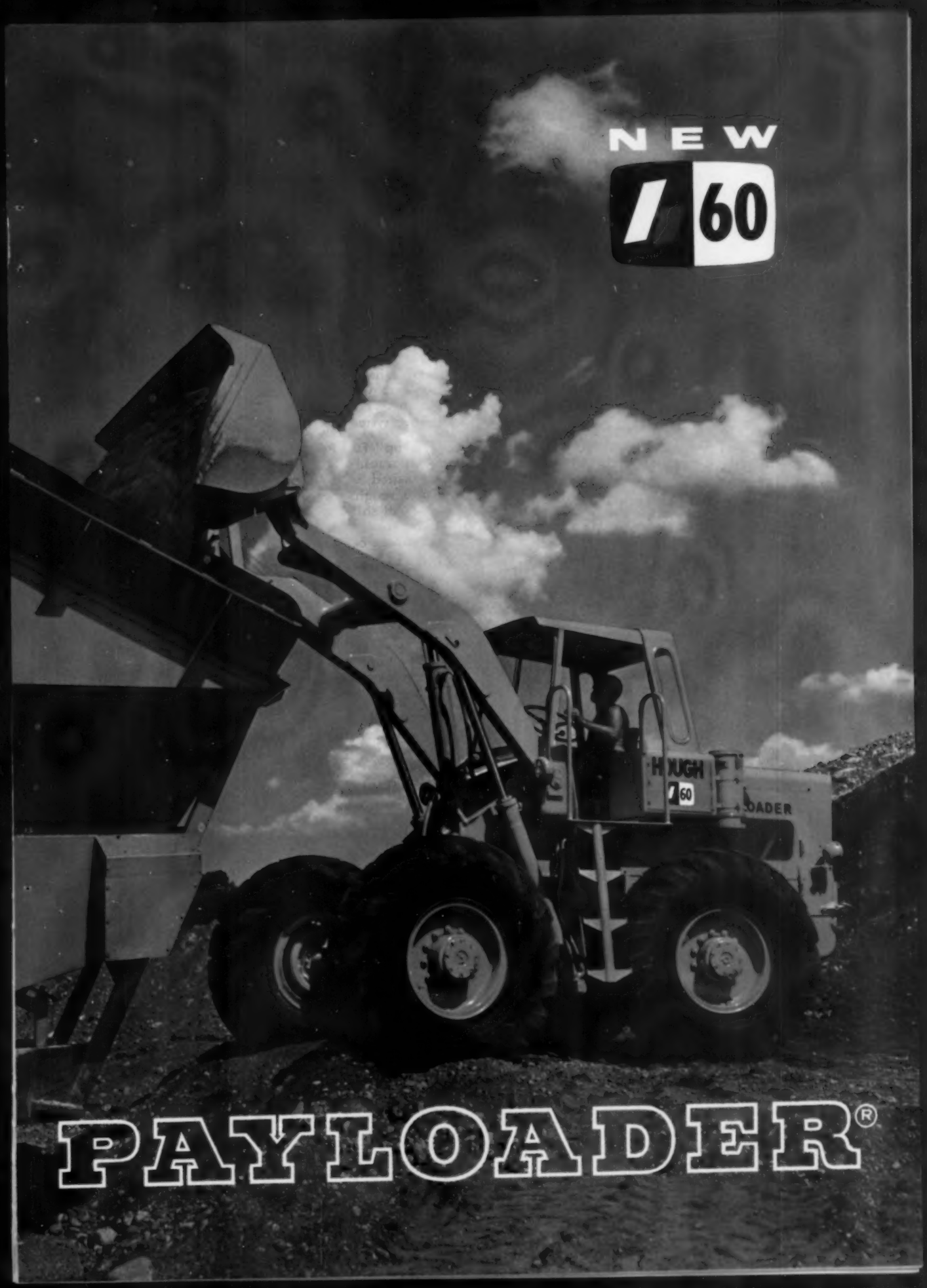
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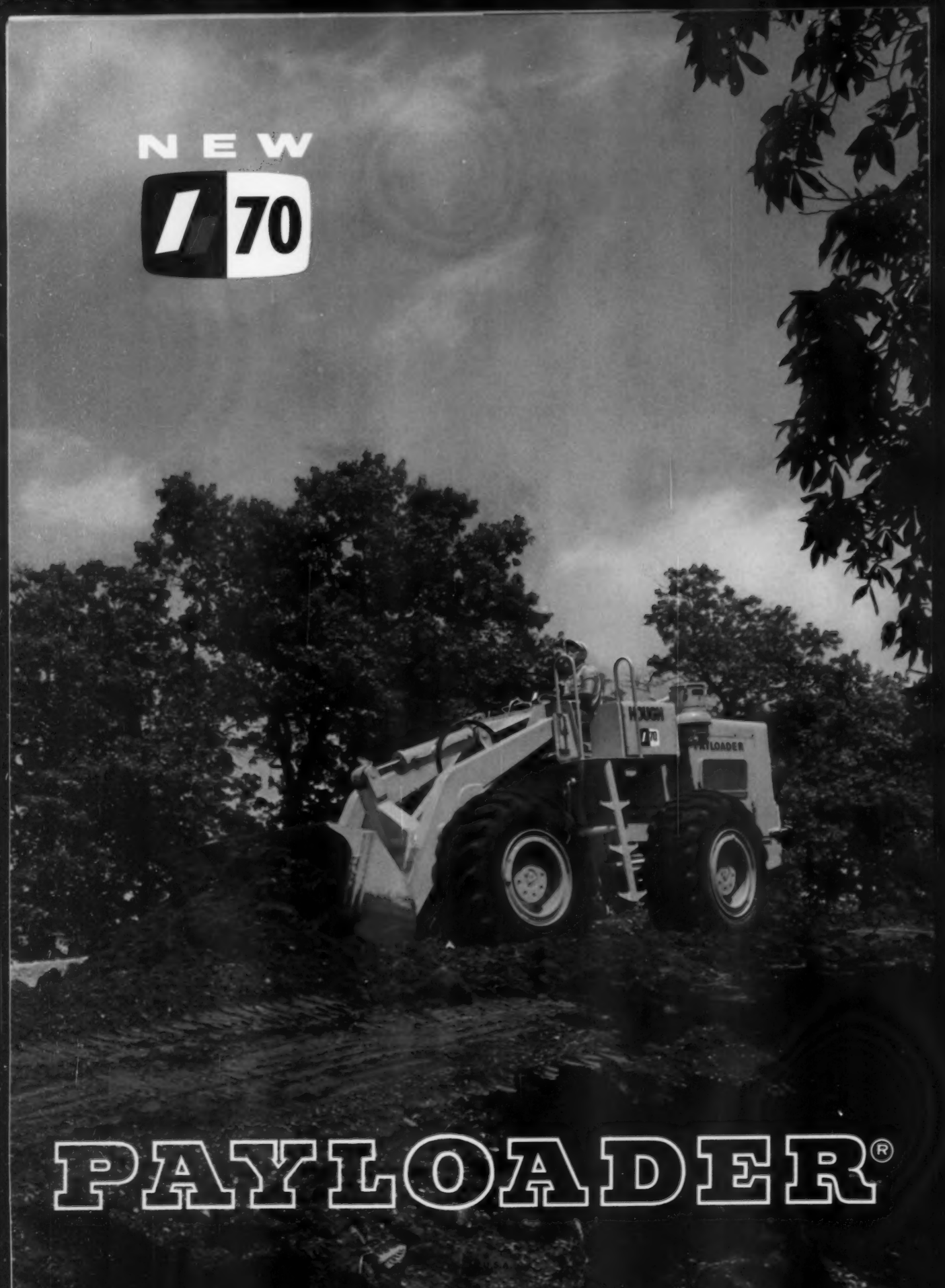

PAYLOADER®

No. 3 in a series of announcements on new HOUGH *machines*

The new 2½ cu. yd. PAYLOADER

has everything

according to the aggregate producers and contractors who tested this unit

The advanced design and exclusive features of this new H-70 series "C" model were subjected to many months of continuous, rugged testing by users on actual job-site locations before final evaluation.

Those items which contributed the most to the unmatched performance of the smaller H-30 and larger H-120 four-wheel-drive PAYLOADER models during the past two years served as a guide for the development of this completely new 2½ cubic yard tractor-shovel.

By comparison with the previous model, the H-70C has increased capacity, more power, greater flotation, additional reach, easier handling, simplified maintenance, new safety features and vastly superior performance. Some of the features are:

More Capacity: An increase of 25% in the size of the standard bucket, from 2 to 2½ cubic yards. (S.A.E. rated) Optional buckets from 1⅜ to 5 cu. yds. are available.

More Power: The new heavy-duty diesel engine delivers 148 hp which is an increase of 20% over the previous model. This gives the H-70C more horsepower per pound of machine weight than any comparable machine.

Safety and Convenience: All bucket and boom mechanisms are located ahead of the operator compartment for maximum protection. The steeply-sloped cowl and open design give 100% visibility. A comfortable, adjustable bucket seat and conveniently located controls make operation easy. Safety ladder and hand rails provide easy access to the walk-in driver compartment.

Less Maintenance: The only loader in its class with simplified PAYLOADER boom mechanism and single bucket tilt cylinder. This means you have from 4 to 10 fewer pivot and grease points and fewer parts to service and maintain. In addition, all pivot points on steering, boom and bucket mechanisms are fitted with "O" rings and other seals which keep grease in and dirt out to provide longer life and less maintenance.

"Keep-clean" Hydraulic System: A valuable, exclusive HOUGH feature is the closed and pressure-controlled hydraulic system to keep out air-borne dust and moisture. The new cylindrical, vessel-type reservoir has extra strength and the entire top is easily removed for thorough maintenance and easy servicing. There is a complete full-flow micronic filtering system.

"No-stop" Full Power-shift Transmission: This HOUGH transmission was developed exclusively for rubber-tired tractor-shovel requirements and has been thoroughly proven on thousands of PAYLOADER units. All shifts, up or down, forward or reverse, can be made "on-the-go" with no stops for any "range-shift" engaging of gears.

The H-70 series "C" has many other proven HOUGH features including a separate fan-cooled, oil-to-air radiator for effective cooling of both torque-converter and transmission oil; torque-proportioning differentials for better traction; "operator's choice" dual brake pedals which permit braking with or without transmission engaged. For complete information on the tractor-shovel that "has everything" see your HOUGH distributor or use the coupon.

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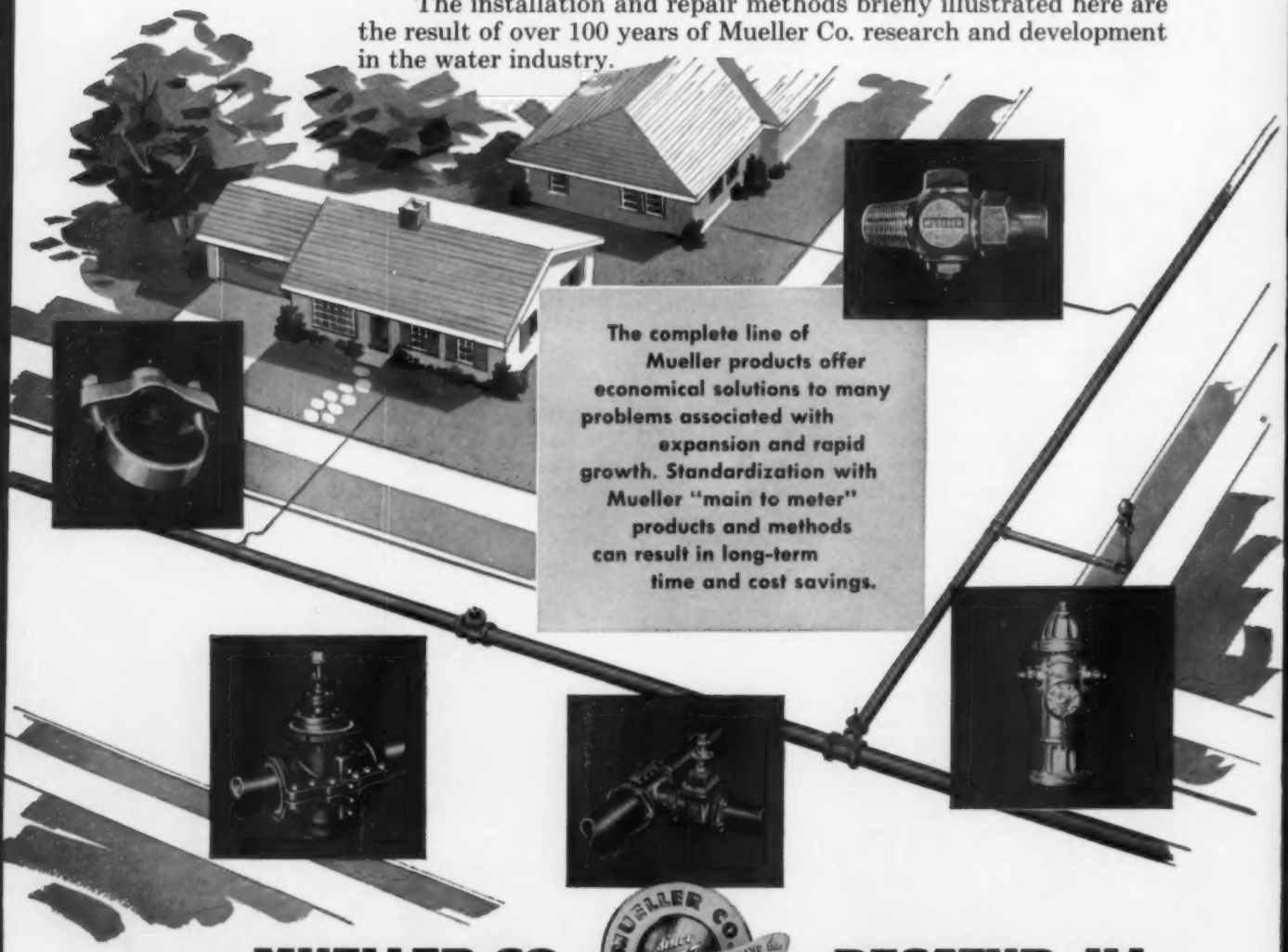
design matched and precisely engineered to work together

for trouble-free control of services!
economical long-life operation!
ease of installation and repair!

■ The development of the line of Mueller installation machines and methods has progressed hand-in-hand with the development of the broad line of Mueller Valves and Fittings. Every improvement in this design and work-matched line of products has proven to be beneficial to the Water Works industry in labor saving, time saving, safety, improved operation and operating dependability.

The installation and repair methods briefly illustrated here are the result of over 100 years of Mueller Co. research and development in the water industry.



The complete line of Mueller products offer economical solutions to many problems associated with expansion and rapid growth. Standardization with Mueller "main to meter" products and methods can result in long-term time and cost savings.

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Making service connections with Mueller B-100 Machine and Mueller Corporation Stop.

Lower section of machine is secured to main. Boring bar assembly with drilling and tapping tool is assembled to lower section.

Main is drilled and tapped in one operation. Boring bar assembly is removed and tool is replaced by corporation stop. Machine is reassembled and corporation stop is inserted.

Machine is removed and service connection is made.

Installing Mueller Corporation Stop to thin walled pipe with Mueller E-4 Machine and Mueller Service Clamp.

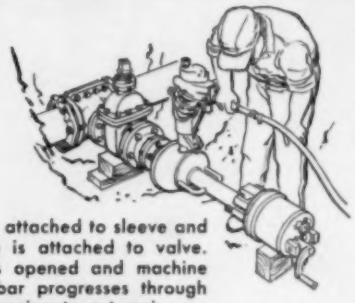
Service clamp is secured to main. Corporation stop is securely threaded into service clamp.

With stop in open position, machine is attached to stop. Tool passes through stop and drills main. Drill is retracted — stop is closed.

Machine is removed and service piping is secured to stop. Stop is opened to activate service.

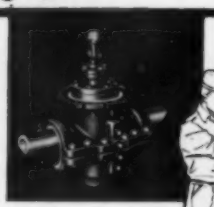
Adding a lateral connection under pressure with Mueller Tapping Sleeve and Valve and Mueller CL-12 Machine.

Tapping sleeve sections are secured to main to provide valve connection and to strengthen main.

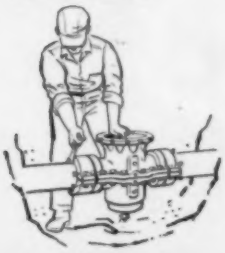


Valve is attached to sleeve and machine is attached to valve. Valve is opened and machine boring bar progresses through valve opening to cut main.

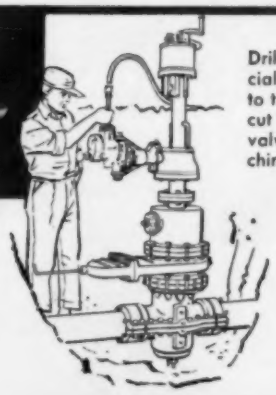
Boring bar is withdrawn through valve —valve is closed— machine is removed. Lateral piping is connected to Tapping Valve.



Adding Gate Valve Control under pressure with Mueller Inserting Valves and Mueller CL-12 Machine.



Valve sleeve halves are secured to main to provide strong valve body at point of needed control.

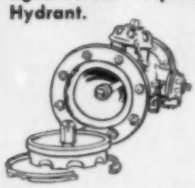


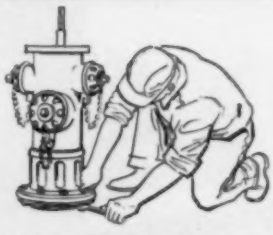
Drilling machine with special slide valve is secured to top of valve sleeve and cut is made in main. Slide valve is closed and machine removed.

Inserting adapter is secured to slide valve. Drilling machine secured to adapter then inserts gate valve assembly through adapter into valve body.

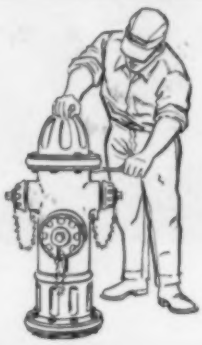
Fast repair of traffic damaged Mueller Improved Fire Hydrant.

Special safety flange has prevented breakage of barrel—special safety coupling has prevented damage to the stem. Both snap off on impact above ground with no loss of water.





With a simple safety flange repair kit, the damaged parts are replaced and the hydrant reassembled.



The Mueller Improved Hydrant is back in service in minutes.

Seven years of field experience prove it! YOU CAN MAKE

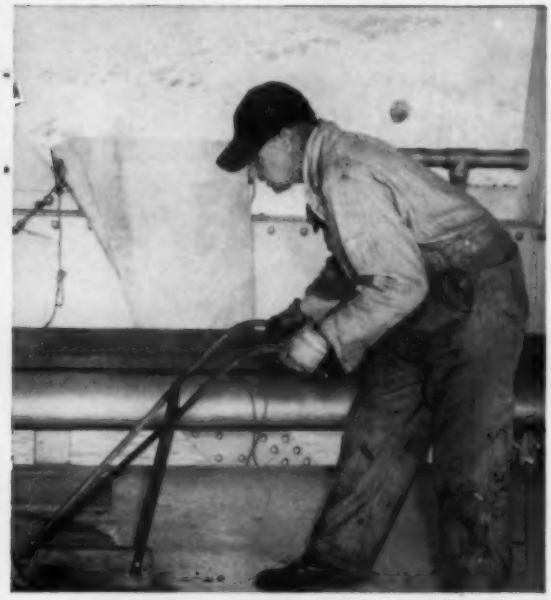
BROKEN ABUTMENTS: Restored stronger than new by brushing on polysulfide-epoxy adhesive to rejoin old concrete, or to bond fresh concrete to old.

FILLING RUTS AND DIPS. Adhesive and aggregate mixed in ratio of 1 to 5 is spread and troweled right over depressed area. No digging down to roadbed or exposing steel reinforcements.

SPALLED JOINTS: Repaired in two hours by using polysulfide-epoxy mixed with aggregate as trowelable compound. Reduces tie-up time as much as 48 hours.

FASTENING TRAFFIC MARKERS. Fixed to road surface with polysulfide epoxy adhesive alone, lane strips have stayed rigidly in place for long periods of time.

LITTLE OF BIG REPAIRS



...with concrete adhesive based on THIOKOL liquid polysulfide polymer

Two chemicals in combination, THIOKOL liquid polysulfide polymer and epoxy resin, are providing one of the most useful engineering tools of our time.

Together, they produce a brushable, quick-cure adhesive used to join old or fresh concrete to old...to bond skid-proofing materials to roadways...to seal and protect surfaces against chemical attack and water seepage. The resultant bond is stronger than concrete itself, waterproof, acid resistant, and flexible enough to withstand repeated freeze-thaw cycles.

Repairs which heretofore required days of labor and road down-time, the use of heavy equipment and large crews of men are now being completed at a fraction of the cost in time, manpower, material and dollars. Serviceability of such repairs is, by actual experience, proving more satisfactory than those achieved by conventional methods.

Want to know more about this new engineering material? How it's used? Where it's used? The benefits and economies that accrue? Write to Thiokol for brochure CA-200.

POT HOLES: Repaired to featheredge and ready for traffic in as little as three hours when patched with mortar mix of polysulfide-epoxy, sand or aggregate.

HAIRLINE CRACKS: Filled with polysulfide-epoxy. Adhesive film sprayed or brushed over surface seals out water, checks further deterioration.

SCALED AREAS: Repaired in only a few hours with adhesive containing THIOKOL liquid polysulfide polymer. Bonds new concrete to old. Watertight bond stronger than concrete itself.

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Municipal Power

Mechanical Design of Transmission Lines

BRUCE J. ENNIS
Associate,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

FROM time to time, the management of an average electric system is required to consider the construction of a transmission line, to transmit large blocks of energy from a power source to a distribution point substation, or to furnish an interconnecting link with a neighboring utility or power source. Depending on the size of the system, such transmission lines will generally fall within the voltage range of 13.2 KV to 161 KV, with 230 KV or higher for the very large systems.

Due to the importance of such transmission lines, it is necessary to provide a design which will result in high service continuity, adequate capacity, safe operation, and ease of maintenance coupled with simple and reliable structures requiring the minimum investment.

Assuming the prior determination of the required electrical characteristics for the line, such as operating voltage level, transmission capacity, steady state and transient stability, and related factors, it then becomes necessary to proceed with the mechanical design for the line to be constructed. In general, rather than in specific terms, certain factors to be considered in transmission line design include the following:

Location: If the line is to be built outside of urban areas, a tentative selection of the route should be made from available aerial photographs, agricultural and county maps, geological surveys, and similar sources of information. For ease of access, construction, operation and maintenance, the line should parallel roads and highways, with due consideration given to maintaining a sufficient distance therefrom to avoid the possible expense of line relocation, should the highway be widened in the future. From aerial photographs, it is possible to select a route requiring the minimum traversal of heavily wooded areas, cultivated fields, swamps, and rough, inaccessible terrain. Carefully selected control or angle points may then be determined for the line route.

Right of Way: With a surveying crew, accompanied by a right of way agent, a transit line should be run between control points using hub stakes and identifying the transmission centerline at fence crossings by colored cloth strips, to aid the agent in securing easements from the property owners for the final line location. For the usual transmission line, the right of way should be for a distance of 25 feet or more each way from the centerline. A 100-foot right of way is, of course, preferable to a 50-foot right of way for purposes of facility of guying without additional easements, freedom from side timber hazards, etc.

Plan and Profile: After the line has been located, a survey may be made along the centerline of the route, taking levels at 100 foot intervals (and at intermediate points where sharp breaks appear in the ground surface) from which plan and profile drawings are prepared to a scale of 400 feet to the inch horizontally, and 40 feet to the inch vertically. Side shots, either side of the centerline, should be taken wherever the ground slopes more than 10 degrees across the transmission line centerline. Since the plan and profile drawings are used to spot structure locations, these side shots are necessary to assure adequate clearance beneath the outside conductors of the line on the uphill side.

Drawings should show property ownership, railroads, highways, wire crossings, navigable streams, and other items for which permits, easements, licenses, and franchises are to be secured.

Line Design: After the plan and profile drawings have been prepared, and the basic economical design for tangent, angle pole, and dead-end structures determined (as based on required clearances, strength considerations, etc.), a ruling span is selected. The ruling span, defined as the average span plus two-thirds of the maximum span minus the average span in any given section of line between dead-ends, is used for preparation of a sag template (as described in conductor manufacturers bulletins) to the same scales as the plan and profile drawings. Each pole fixture is then spotted on the drawings by applying the sag and clearance template to the line profile successively from control point to control point, to complete the layout plans for the transmission line.

Design Criteria: The basic design of the transmission line, especially with regard to conductor clearances, strength of poles, guys, etc., should be in full conformance with the requirements of the National Electrical Safety Code of the National Bureau of Standards, and local state, railroad, and other codes having jurisdiction. The design is based on the type of weather-loading district in which the line is to be constructed such as "heavy", "medium", or "light", by which are defined the extent of temperature, icing, and wind conditions normally expected in the locale. Regardless of any such general classification, prudent design for adequate strength should take into account known local conditions in which the line must operate, and the design requirements should be increased accordingly. For example, the Mississippi Gulf Coast is classified as a "light" loading district. Actually, due to the influence of hurricane-force wind (for a distance of 100 miles or so inland from the Gulf) it is safer practice to design lines in that area with the maximum stength requirements specified for either "medium" or "light" loading, whichever produces the greater loading for the particular size of conductor selected for the transmission line.

As a general rule, the pounds of force exerted per square foot on the cylindrical surfaces of poles and conductors is equal to 0.0025 times the velocity squared of the wind in miles per hour. Thus, a wind of 40 mph would exert a force of 4 pounds per square foot; and a wind of 60 mph would exert 9 pounds per square foot on the projected area of each conductor attached to the pole, as well as on the pole itself. For hur-

ENTERPRISE *TRI-FUEL* ENGINES

SAVE 75 PERCENT OF FUEL COSTS AT BOWERY BAY

- *great versatility*
- *fast change-over*
- *automatic cut-back*
- *high output at low cost*
- *with Select-O-Matic® Controls*

Enterprise Select-O-Matic® Control sets the engine on either diesel or dual fuel operation. This single control automatically determines the ratio of fuel oil to gas, insuring continuous service and sustained optimum combustion efficiency, and prevents loss of engine power and speed.

Four Enterprise Model TDSQ 318 Tri-Fuel Engines at the Bowery Bay Pollution Control Project, Astoria, New York, are saving the cost of three quarters of the fuel required for treating sewage. Each is an eight-cylinder supercharged Enterprise Engine rated 1755 HP at 360 RPM and would normally consume 2,000 gallons of fuel per day; but by utilizing the free sewage gas (methane), produced by sludge digestion, requires an average of only 500 gallons in dual fuel operation.

The versatile Tri-Fuel Enterprise Engines perform triple services in the Bowery Bay Plant, supplying (a) power to pump 100 million gallons of sewage per day; (b) power for four 1,000 HP induction motors that drive four 25,000 CFM air compressors; (c) heat to maintain a 90 degree temperature in the sludge heating systems, and comfortable heating for the buildings.

Whether your municipal power requirements are greater or less than the Bowery Bay Project, there is a complete line of dependable heavy-duty Enterprise Engines available, for diesel fuel, dual-fuel, tri-fuel, or spark ignition operation. Models from 73 to 7703 HP. Contact us today for the full story.

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APCO SUPER-DeLAVAUD CAST IRON PIPE WITH ALTITE® JOINTS

meets ALL 10 requirements for underground mains

- Service for centuries
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Murdock Water Devices are designed for Years of Service in the roughest Outdoor Use. "Guaranteed Satisfaction" for over 100 Years.

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HYDRANTS
STREET WASHERS
ANTI-FREEZING COMPRESSION HYDRANT
SELF-CLOSING ANTI-FREEZING HYDRANT

ricane force winds of 100 mph or so, the resultant force would be in the order of 25 pounds per square foot. For flat surfaces, the wind pressure is approximately 60 percent greater than for cylindrical surfaces. Under conditions of maximum design loading, the design tension of transmission line conductors should not exceed 50 percent of the ultimate breaking strength of the conductor for the ruling span selected.

In the United States, isokeraunic maps indicate the number of thunderstorm days per year, varying from 5 to 90, depending on geographical and meteorological location. In areas having an isokeraunic level of 30, each mile of line might be subjected to one lightning stroke per year. In such cases, and in more severe areas, an overhead ground wire structure design to permit shielding the line conductors will result in better service continuity and improved protection against outages due to lightning. The selection of the size and type of shield wire should be matched to the line conductors so that the sag of the shield wire at 60°F will be only 80 percent or less of the sag of the conductors. By so doing, the midspan clearance between the grounded shield wire and the energized phase conductors will be improved for better coordination under varying sag and tension conditions. The American Standards Association has established seven "classes" for electric system wood poles. Regardless of the type of wood and length of pole, the minimum required circumference at the top of the pole is 27 inches for a Class 1 pole, 25 inches for a Class 2 pole, 15 inches for a Class 7 pole, etc.

For a given "class" of pole, the "ground line" circumference at 6 feet from the base of the pole will vary depending on the type of wood. Thus the ground line circumference of a 50 foot Class 4 pole will be 37.5 inches for southern yellow pine and 47.5 inches for northern white cedar. In both cases, the resisting moment of the pole will be approximately 102,000 foot-pounds, indicating the higher fiber stresses of 7400 pounds per square inch permissible in the southern yellow pine as against only 3600 pounds per square inch in the northern white cedar. Either pole, of course, would offer equivalent strength for supporting the transmission line conductors and shield wires. The selection of the type of pole for a given project will depend upon its availability and its comparative cost delivered to the area, other factors being equal.

Depending on the economic design of the line, the inter-phase clearances required for the operating voltage, etc., the pole line structures may be of the single pole, or double pole H-frame type. In the latter case, the dual-pole transverse strength of the H-frame structure may be increased by the addition of X-bracing between the two individual poles of each structure. This is especially desirable in long-span construction such as across a valley between two hill top mounted structures.

As a general rule, the minimum depth of setting for poles in earth should not be less than 10 percent of the pole length plus 2 feet, approximately.

If the type of structure selected is based on the use of suspension insulators for the conductor supports, the position of the end of the insulator string will vary with different conductor temperature conditions, line angles, wind, ice loading, etc. This, in turn, will affect the clearances of the conductors from the supporting structure and from other conductors and guy wires; therefore, the effects of possible insulator swing should be computed to provide adequate clearances under all operating conditions. If the structure design is of the pin or line-post type of insulator, the conductor is fixed in position up to the maximum allowable transverse load on the insulators.

After the line has been completely designed, staking sheets should be prepared ready for construction on which are listed each pole number, the height and class of poles, the type of each structure, the span lengths between poles, the type and size of conductors, shield wires, grounding assemblies, and guying, and other information necessary to specify the complete requirements for the transmission line construction. □ □ □

• • •

Wanted: Break-In Operator for Activated Sludge Plant

An activated sludge plant in the middle South, with a capacity of 12 mgd, will be completed in the spring of 1962. At that time the contractor will require, for 60 days or longer, a skilled operator to run the plant, synchronize equipment and instruct personnel in operation and in the maintenance of equipment. Each of the major equipment suppliers will furnish an engineer for the start-up and initial operating period. Address Box 10K, Public Works, 200 South Broad St., Ridgewood, N. J.

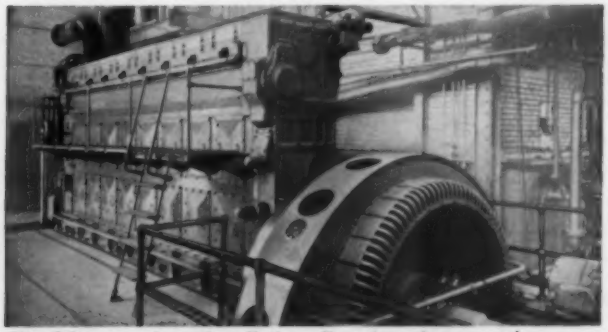
Superior's low fuel oil consumption is measured here by (left to right) Clarence Garrett, Plant Supt., A. B. Reese, Jr., White's Chief Field Engineer, and V. V. Long, Engineering Consultant, Kingfisher, Okla.

Civic thrift at Kingfisher prompts Superior Engine purchase

Kingfisher, an Oklahoma wheat belt town of 3700 population, is proud of its low municipal taxation. Earnings from the city-operated power plant pay most local operating expenses and finance periodic improvements and expansion to the plant itself. As usual, city fathers were both cautious and thrift-minded when a new engine-generator was needed recently. Their choice was a Model 80-GDSX-8 dual-fuel supercharged Superior which develops 1769 BHP at 360 RPM, to drive a 1250 KW generator.

Today many municipalities are making a "Superior decision"! Superior's highly developed open chamber combustion system is combined with a series of exclusive design developments and refinements to produce high power-to-fuel ratio. Diesels can run on a wide range of non-premium fuels including residuals, and dual-fuels operate on natural or manufactured gas, butane, propane or sewage gas. Even after extremely long periods of low-maintenance operation, replacement parts are seldom needed.

Superior's complete line of diesel, dual-fuel and gas engines range from 190 to 2150 HP, or 150 to 1500 KW. Get full information today by writing to:



Kingfisher saved on installation. Experienced power plant crew poured base and completed hook-up.

Superior ENGINES · ATLAS Imperial DIESEL ENGINES · White DIESEL

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

6-cylinder 94* engine h.p. JOHN DEERE 4010

*Diesel; 92 eng. h.p. Gasoline

NEW POWER FOR THE LONG PULL

Designed for big work output at blade and drawbar, bucket and powershaft, the new John Deere "4010" has both the reserve power and the flexibility that fast-paced construction schedules require.

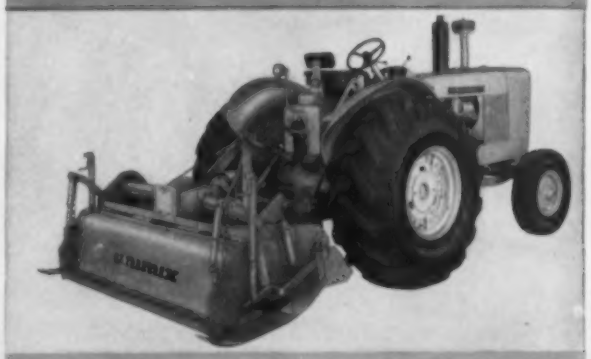
Two large-capacity hydraulic systems speed stockpiling and material handling with the "4010" Loader. Smooth power braking in both directions, and power steering are supplied by a central, constant-pressure system. Bucket and lift arms, operated by single-lever control, are powered by separate, constant-volume pump.

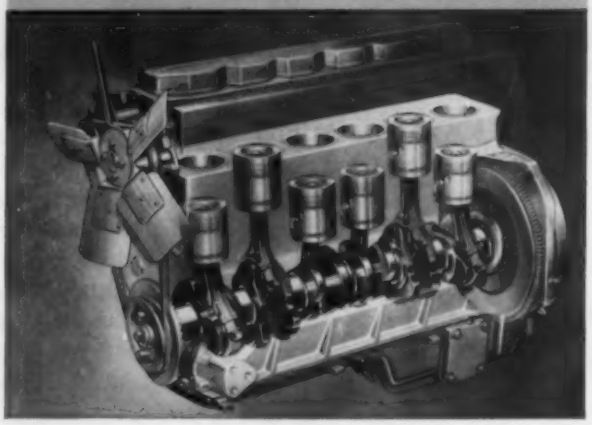
Well-adapted for a wide variety of work with rear-mounted equipment, the "4010" delivers top performance from tampers and rollers, soil-cement and bituminous mixers, harrows and other specialized tools. Optional three-point hitch precisely controls cutting depths with mixers and disks. Independent power take-off available as special equipment: Rear switches from 540 to 1000 RPM in seconds; front is for 1000 RPM only. Wide-swing heavy-duty drawbar or standard drawbar adjustable for length and height meet all requirements. PTO and hydraulic controls are arranged for easy reach from comfortable, back-supporting seat.

Exceptionally heavy construction of the 6-cylinder engine is marked by a high-inertia, 150-pound, forged steel crankshaft with seven main bearings, solidly supported by interior webbing. Pan is a one-piece casting providing extra rigidity and engine protection. Pistons are aluminum alloy for rapid heat dissipation: special for each fuel type. Forced engine ventilation, exhaust valve rotators, full-pressure lubrication, and replaceable cylinder sleeves surrounded by coolant improve operation, increase engine life. Constant-mesh transmission, 8 speeds forward, 3 reverse.

To arrange for a demonstration, and obtain facts on the John Deere Credit Plan and long-term leasing, see your dealer. Check the yellow pages.

John Deere, 3300 River Drive, Moline, Illinois





JOHN DEERE LOADERS BULLDOZERS BACKHOES AND EARTHMOVING EQUIPMENT

JOHN DEERE

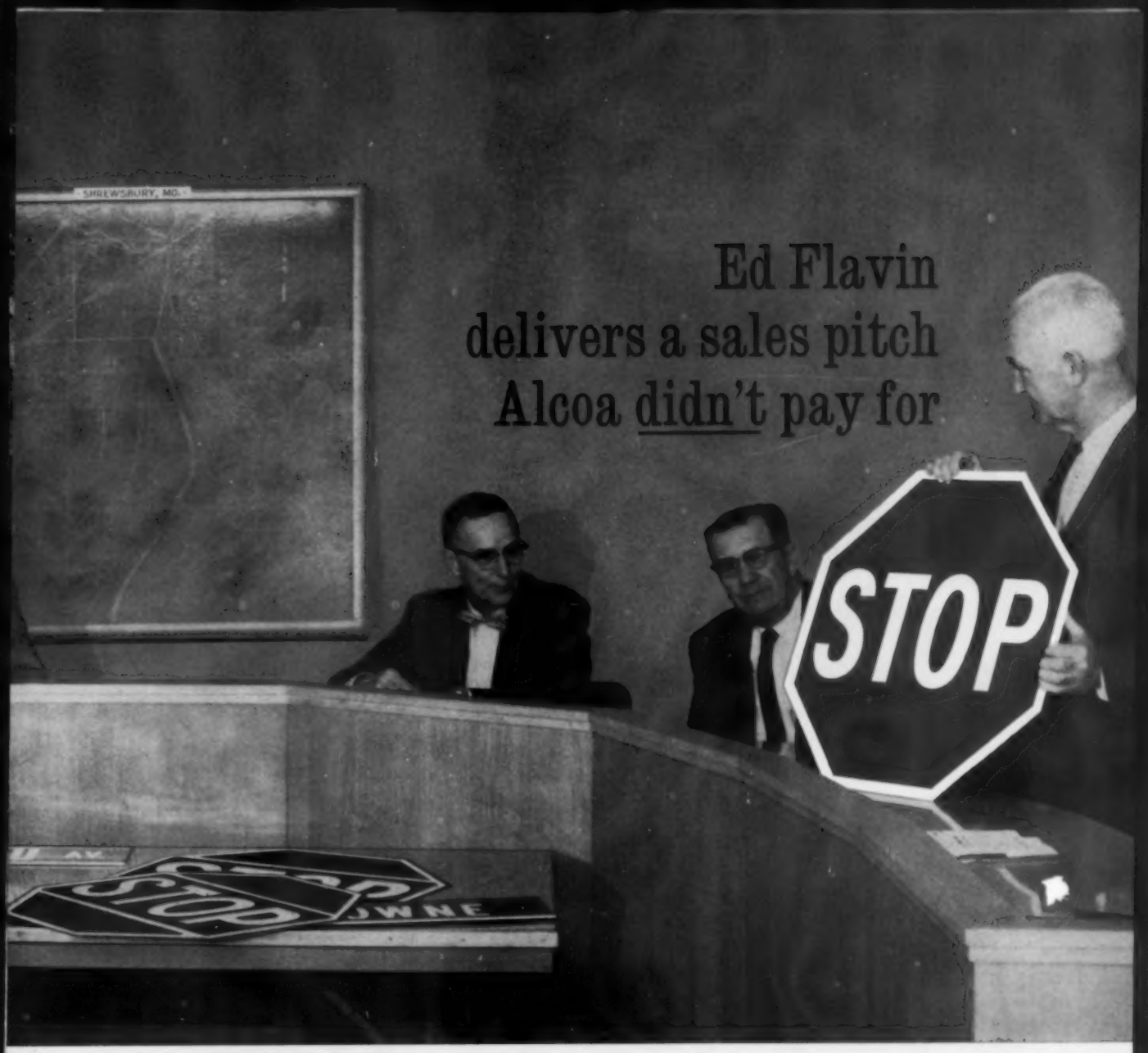
"IMMEDIATE maintenance savings—that's what we got by replacing all our old signs at one time with new ones of Alcoa Aluminum!" Mayor George J. Helmsing of Shrewsbury, Mo., states further, "Our old signs were deteriorating fast, were very ugly. Ed Flavin and I knew we could stop this by using aluminum signs and the recommended reflective sheeting. Ed made the pitch to Council."

"We went the way of St. Louis County," added Street Commissioner Ed Flavin. "I got several bids on sign materials . . . all types and shapes. We looked at samples and the Alcoa jobber gave us a lot of help.

"The aluminum signs were competitively priced," Mr. Flavin continued, "and with the additional savings in upkeep and maintenance, there was no question as to which of the sign materials would be better."

"Aluminum signs never rust . . . stand

Police Chief Fred J. Huncke points with pride to a new stop sign of Alcoa Aluminum—one of many such signs installed by the City of Shrewsbury, Mo. Street Commissioner Edmond Flavin, Sr., and Superintendent of Public Facilities Joseph Klausner look on approvingly.



Ed Flavin delivers a sales pitch Alcoa didn't pay for

weather much better," added Chief of Police Fred J. Huncke and Superintendent of Public Facilities Joseph Klausner. "Every two years, old signs had to be removed, sanded and repainted. With aluminum—put it up and it stays!"

The program was approved unanimously.

This is a true story. The facts are there. Following the example set by St. Louis County, the City of Shrewsbury voted to replace immediately *all* their street and stop signs with signs of Alcoa® Aluminum. And even though we couldn't make the presentation ourselves, we thank Ed Flavin for the fine selling job.

Call your nearest Alcoa sales office and learn how your community can stretch tax dollars with Alcoa Aluminum Street and Stop Signs . . . and at the same time qualify for the big FREE Alcoa "Welcome to Your Town" sign. Or write: Aluminum Company of America, 897-K Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

HIGHWAY PRODUCTS

Clearing runways, Trojan's dumping height handles capacity loads for high side-boarded trucks during blizzard conditions at New York International Airport.

Trojan's high-capacity snow bucket quickly stockpiles snow to free the parking area of this New England community.

A Trojan model 204 with front-mounted snow-blower loads windrowed snow into trucks for disposal outside this Wisconsin town.

The Village of Hamburg, N. Y. coordinates its D.P.W. tools by using a Model 164 Trojan to widen thoroughfares.

TROJAN ATTACHMENTS DO MORE JOBS—BETTER

Trojan's quick-change attachments make it possible to adapt your tractor shovel to handle the special jobs, faster. Four pins on those attachments mounted in place of the bucket allow fast changeover . . . and pay-off many times over in added production. Trojan's snow bucket, one-way or V-type plows, and snow blower are all ideal for winter snow removal. The crane hook or back fill blade economically handle municipal water and sewer line projects without the addition of specialized equipment. With the deep-digging backhoe attachment, even greater work assignments can be handled by Trojan. Ask for the details on all the versatile Trojan attachments designed to add year-'round versatility to your public works program.

TROJAN moves snow ...when others can't go

When snow spreads its paralyzing blanket in cities, towns, on highways and airports... when arteries of transportation are strangling... and the efficient performance of municipal service is jeopardized — a Trojan tractor shovel can be the most valuable piece of equipment in your garage.

With a Trojan tractor shovel, an unexpected storm need not be an emergency. Trojan's four wheel drive and unexcelled traction move in on the heaviest drifts with knifelike ease... even in snows that stop conventional truck-mounted plows. Your Trojan can load chlorides and abrasives at stockpiles... quickly handle truckloading with its special high-capacity snow bucket. A Trojan operator sits in comfort in an all-weather cab — the fatigue that comes from long hours of snow fighting is virtually eliminated.

Clear snow quickly and economically with a Trojan tractor shovel. Seven models with lift capacities from 7,000 lbs. to 24,000 lbs. provide the answer to your snow removal problem. Contact your Trojan distributor now.

Trojan model 114 with one-way plow clears heavy drifts while plowing in a rural area of northern New Jersey.

Near Chicago, a Trojan model 134 efficiently clears street intersections to ease traffic flow.

MODEL 114
Lifting Capacity 7,000 lbs.
¾ to 2 cu. yd. buckets.

MODEL 134
Lifting Capacity 8,000 lbs.
1 to 2½ cu. yd. buckets.

MODEL 164
Lifting Capacity 10,000 lbs.
1⅓ to 2¾ cu. yd. buckets.

MODEL 204
Lifting Capacity 12,000 lbs.
1⅔ to 3 cu. yd. buckets.

MODEL 254
Lifting Capacity 15,000 lbs.
2 to 4 cu. yd. buckets.

MODEL 304
Lifting Capacity 18,000 lbs.
2 to 5 cu. yd. buckets.

MODEL 404
Lifting Capacity 24,000 lbs.
3 to 6 cu. yd. buckets.

TROJAN®
TRACTOR SHOVELS
YALE & TOWNE

AD NO 44-50

THE YALE & TOWNE MANUFACTURING COMPANY
TROJAN DIVISION • BATAVIA, NEW YORK

engine power
BY CATERPILLAR

WHEN POWER FAILS CAT ELECTRIC SETS KEEP MIAMI INTERNATIONAL BRIGHT

Miami International Airport, Dade County, Florida, one of the busiest airports in the United States and a world leader in air cargo. Building above is protected from loss of utility power with a dependable Cat Diesel Electric Set.

In the path of Caribbean hurricanes, one of the world's busiest air terminals has a higher than average risk of utility power loss. Cat Electric Sets were part of the planning; power outages last only a few seconds as automatic controls furnish emergency power to equipment and lighting in the main passenger terminal. The Cat D397 provides power as long as the utility power is interrupted.

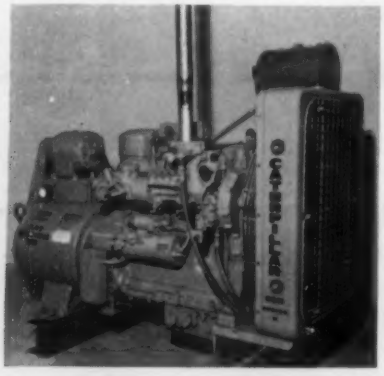
In another terminal area—the Pan American World Airways' ticketing and passenger section—a Cat D311 Electric Set stands by to immediately provide power in the event utility power fails.

When you plan buildings where people gather to work, to live, to shop, to dine, to relax or to recuperate, add dependable Cat Diesel or Natural Gas Electric Set protection. A Cat Standby Set has the power to safeguard lives, prevent panic, looting and loss of revenue. It enhances the value of the building. A single power loss will attest to the wisdom of Cat standby power.

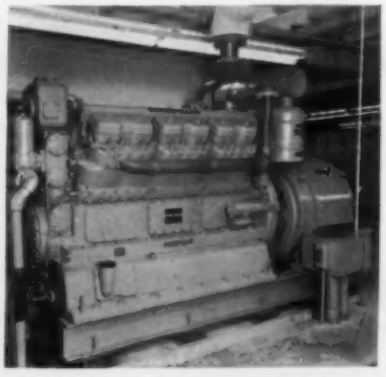
When properly installed, Cat Electric Sets will start in as little as 6 seconds after a utility power outage occurs. Installation requires little or no special or additional construction. Fuel storage for Cat Diesels requires no special protection against explosion because they use non-explosive diesel or furnace oil. Cat Natural Gas Engines are equally simple to install.

The cost of owning, as well as the cost of buying, Cat standby power is low. Caterpillar's 4-cycle operation . . . the fuel system—the inherent design simplicity—mean extreme reliability with a minimum of maintenance.

Caterpillar power is dependable power. See Sweet's File for specification data. Call your Caterpillar Dealer for specification help and complete information.



A Caterpillar D311 Electric Set, rated at 30 KW, furnishes additional power for the Pan American World Airways terminal area. There are Cat Electric Sets rated up to 600 KW suitable for application either as single or multiple units for larger KW loads.



This Cat Diesel Electric Set—Model D397—can furnish 350 KW to Miami International Terminal. This set safeguards people in building, enables work to continue and furnishes power to guide air traffic.

Engine Division, Caterpillar Tractor Co.,
Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

LAYING PIPE UNDER WATER was the tough assignment of Lloyd Kispert & Son, contractors of Green Bay, Wisconsin, at the town of Preble, Wisconsin.

Below the water table... water-tight joints

Lloyd Kispert & Son recently laid 3611 feet of 12-inch K&M Asbestos-Cement Sewer Pipe within a few hundred feet of Green Bay. The water table was so high that the pipe was laid under water. Nevertheless, all joints had to be infiltration-tight. On the next page, Mr. Kispert, in his own words, tells how he solved this problem.

You can dig flatter grades for K&M Asbestos-Cement Sewer Pipe because its bore remains smooth and clean.

Water, snow, mud, and rain can't hold up the installation of K&M Asbestos-Cement Sewer Pipe.

"K&M ASBESTOS-CEMENT GRAVITY SEWER PIPE GAVE US PERMANENTLY TIGHT JOINTS IN WET GOING!"

"This was an extremely rough job. But, with K&M Pipe, we got tight joints in wet going. The K&M FLUID-TITE® Coupling connected easily, even under water. The men just had to lubricate the tapered end of the pipe and slide it into the coupling. We didn't need any heavyweight coupling pullers. Our men had an easy time handling the pipe because of its light weight. We are very satisfied with K&M Pipe and will use it again."

Mr. Lloyd Kispert

You could lay K&M Asbestos-Cement Sewer Pipe at the bottom of a 58′ deep lake, and it would be infiltration-tight.

The smooth bore of this modern pipe remains clean, permanently. The friction coefficient is low. You can plan fewer lift stations and flatter grades.

K·M

Keasbey & Mattison at Ambler

For more information on this top-quality gravity sewer pipe, write to: Keasbey & Mattison Company, Ambler, Pa.

NOW...brush killed while nature sleeps

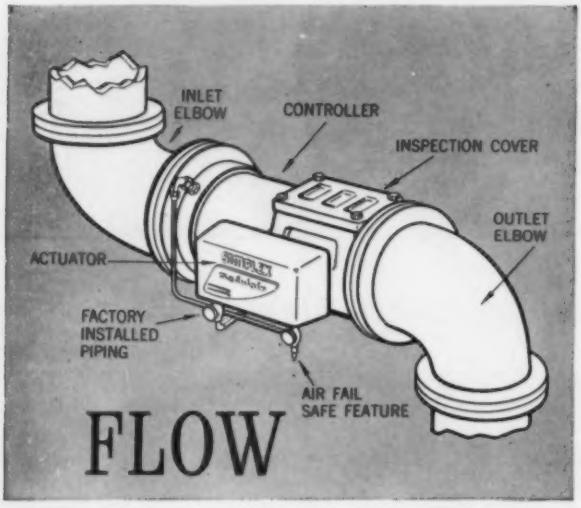
NEW: Dormant Cane Broadcast with Diamond Line Rider formulations
RESULT: Lower costs, extended application season, less risk of crop damage

Three years of commercial and semi-commercial testing are over. The answer is, "Yes." The Diamond Dormant Cane Broadcast method of applying 2, 4-D and 2, 4, 5-T has been proven. The advantages can be put into effect.

This new method can now supersede stem-foliage and basal treatment. Dormant Cane Broadcast treatment can be applied over the entire woody plant from October to February. You use low-pressure sprays—you need only half the time required in basal treatment.

Diamond Line Rider formulations are the proven chemicals from three years of experience—as the best material, they do the best job. Send for technical bulletin on "Dormant Cane Broadcast." Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals



How to control it economically with this simple, modern "box on a pipe."

This is the Modulair Type "P" rate-of-flow controller, for your filter effluent piping.

You install it almost as easily as a piece of pipe, and its design is so utterly simple that you have almost no maintenance cost.

Note how Modulair "P" flow controller requires very little space in filter effluent line.

In fact, the minute you put this venturi-actuated, fully pneumatic controller to work, you get these new savings:

1. No valve operator
2. No water supply
3. No hydraulic valves
4. No drive gears and linkage
5. No "spaghetti" of complicated piping
6. No pilot valve or valve shaft
7. No leaky packing gland
8. No floor drain
9. Almost no maintenance

You save space, too, because the "P" controller has the shortest laying length of any, in addition to being entirely preassembled, with all working parts enclosed.

Send for our Bulletin 951, for details on space and cost savings of the "P" controller. Compare them with your present method of flow control. No obligation.

SIMPLEX® VALVE AND METER CO.
LANCASTER, PENNSYLVANIA
a division of
PFAUDLER PERMUTIT INC.

Ed Cleary Reports on

Reconnaissance of the Frontiers of Public Works Research

EDWARD J. CLEARY
Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

PERHAPS it would not be out of order to suggest that one day the trustees of the Research Foundation of the American Public Works Association may find reason to insert a series of classified ads in professional journals along the following lines:

> **WANTED**—A chemical or biological method to minimize the shedding of leaves from deciduous trees. **Object:** To reduce the cost of street cleaning.

> **WANTED**—A system for transfer of an electric potential or ultrasonic waves from a moving vehicle to pavement surfaces. **Object:** To accomplish prompt and effective removal of snow from city streets.

> **WANTED**—A technique to modify rainfall intensity patterns in urban areas. **Object:** To secure a substantial reduction in the size and cost of storm sewers.

Expression of these and similar needs could be one outcome from a reconnaissance of the frontier of public-works research, which is about to be undertaken by the APWA. Financed in part with a modest grant from the Ford Foundation, the project offers exciting promise of adding new dimensions in the development of municipal services throughout the United States.

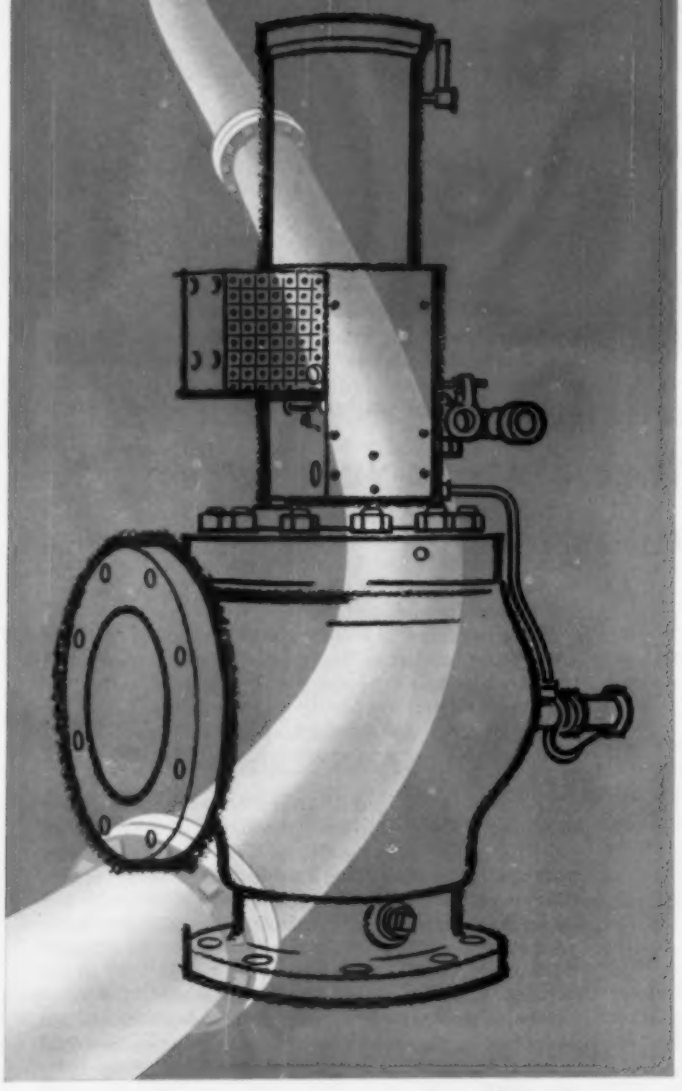
This reconnaissance, preliminary details of which were discussed at the APWA Congress in Minneapolis at the end of September, stems from efforts of a research-oriented foundation established by the association a few years ago. Purpose of the foundation is to identify problems that might justify research effort and then stimulate sponsorship for such research.

Because refuse disposal is an activity universal to all communities, the APWA found reason initially to focus attention on improving practice in this field. And its research foundation can point with pride to the production of manuals that evaluate collection and disposal techniques, and to the conduct of scientific studies on the chemical and physical properties of municipal refuse. These studies are expected to yield data that will improve incinerator design and land-fill practice.

Insure against costly pipeline rupture with

PELTON

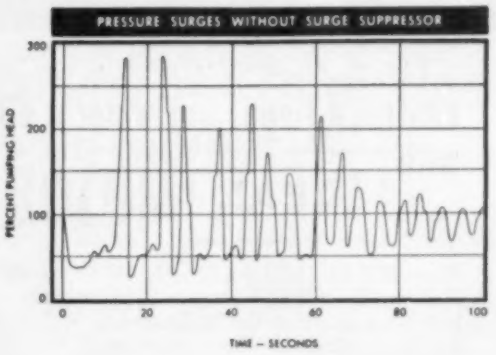
Surge Suppressors

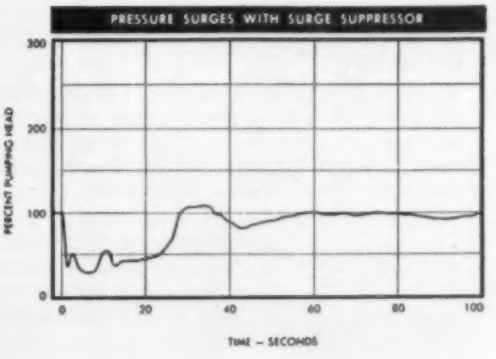


Only you can estimate just how costly—and dangerous—a pipeline rupture in your pumping system could be. Certainly it's no small matter. And that's why the Pelton surge suppressor is such a wise investment.

This device, developed by Pelton, acts automatically to prevent excessive pressure surges in pump discharge lines following stoppage of the pump prime mover. Connected to the discharge pipeline, it opens during the down surge, thus rerouting the reverse water flow around the closed check valve and into the suction reservoir or other disposal point. A normally energized solenoid controls the surge suppressor.

Pelton builds surge suppressors in standard sizes ranging from 2½ to 16 in. and for pressures up to 800 psi. When you specify Pelton you get surge suppressors precision tailored to your needs by the most experienced engineers in this field. For particular information or for literature, write to Pelton Division (B-L-H), 2929 Nineteenth St., San Francisco 10, Calif.

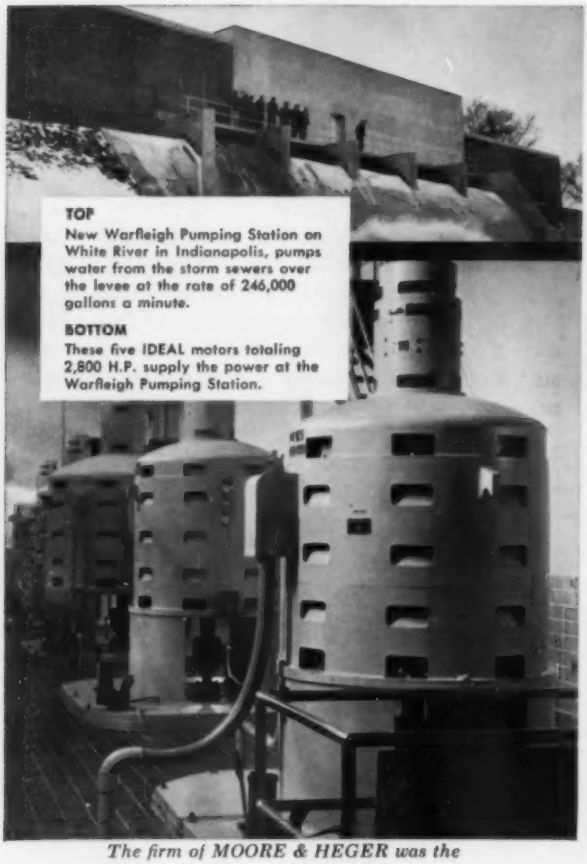




BALDWIN · LIMA · HAMILTON

Pelton Division · San Francisco, Calif.

Hydraulic turbines • Valves • Governors • Centrifugal pumps



TOP
New Warfleigh Pumping Station on White River in Indianapolis, pumps water from the storm sewers over the levee at the rate of 246,000 gallons a minute.

BOTTOM
These five IDEAL motors totaling 2,800 H.P. supply the power at the Warfleigh Pumping Station.

The firm of MOORE & HEGER was the Consulting Engineer on this project.

control a flood...or water a city with IDEAL MOTORS

Five IDEAL Motors, 2—400 H.P., 2—600 H.P. and 1—800 H.P., supply the power to control flood water at the Indianapolis Warfleigh Pumping Station. These slow speed Vertical Solid Shaft Synchronous motors power pumps that have a capacity of 246,000 gallons of water per minute, (enough water to fill a 35' x 75' x 12½' deep swimming pool in one minute).

Whether it is power to control a flood or supply water for a large municipality or commercial use . . . whether 10 or 10,000 H.P. is needed, Ideal Electric can furnish the exact motor for any pumping requirement.

IDEAL'S more than 50 years' experience in engineering and manufacturing electric motors, generators and controls results in IDEAL PERFORMANCE on any job.

Write for Ideal's newest booklet, "Ideal Powers Pumps For The Motor City."

The IDEAL ELECTRIC AND MANUFACTURING COMPANY
610 East First Street Mansfield 3, Ohio
MOTORS, GENERATORS AND CONTROLS TO 10,000 H.P.

The Broad Horizon

Now the stage has been set for a much broader and imaginative portrayal of opportunities where research effort could help public-works administrators in meeting their responsibilities for improving community services and reducing the cost of providing facilities for such services.

As a first step, a contract has been made with Armour Research Foundation of Illinois Institute of Technology to conduct a study designed to delineate present public-works needs and anticipate future ones. Coincident with this the APWA will evaluate current research—of whatever nature—and seek to determine if the results of such research may have application to public-works services.

With regard to present needs, the APWA research steering committee and the Armour investigators are not surprised by the results of some preliminary findings. A sampling of public-works administrators indicates that their present concerns center on: 1) Budgets that are inadequate to provide the kind of services being demanded; 2) difficulties in attracting and holding professionally-qualified men; and 3) an alleged lack of responsiveness by manufacturers in developing specialized equipment. These findings illustrate frustrations. And since dissatisfaction with things as they are can serve as a springboard for initiating change, these and other complaints will be regarded as clues for more intensive probing.

It is from such probings that the APWA Research Foundation expects to catalog areas of public-works activity that should command attention. The next step will be to ascertain where research efforts might be concentrated to produce the maximum return. And finally, the project list will be further narrowed on the basis of availability of resources and probability of success in reaching desired objectives.

Short and Long-Range Prospects

Two interdependent aims are to be served by this approach: 1) The short-range objective of devising more efficient ways for providing present services; and 2) the long-range possibilities of uncovering new techniques for doing things.

There is reason to believe that the areas of scrutiny will not be limited to the technical aspects of public-works endeavor. At least this is the conclusion one might draw from the fact that experts from the fields of sociology, anthropology, history and political science will be among those invited to assist in making final appraisals.

The influence of public policy on public works administration—as expressed through the processes of political decision and social motivation—undoubtedly offers a fertile field for examination. Here the inquiry would be concerned, for example, not with the technology of how to collect garbage but rather with the more fundamental question of who might best render the service. In other words, one might broadly pose the question in this fashion: On what levels of government—local, county or metropolitan —or within the realm of private enterprise—might we find more effective ways of providing community services?

Particularly intriguing would be an evaluation of the role of private enterprise in supplying such services. For example, in the research being conducted by social and political scientists is there any evidence to suggest that private enterprise should be encour-

Morningside Blvd., Port St. Lucie, Florida

"We insist on value...that's why we're paving all our streets with soil-cement!"

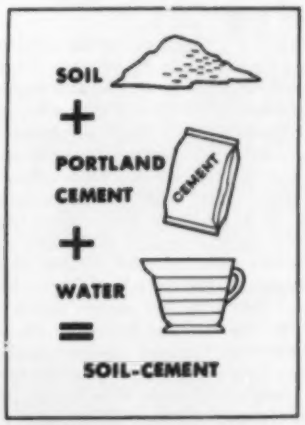
... *Says* **ELLIOTT MACKLE,** *President, The Mackle Co., Inc.*

"Soil-cement is our choice of pavement for the many miles of streets paved each year by The Mackle Company at Port Charlotte, Port Malabar, Port St. Lucie and other General Development Corporation communities in Florida.

"Soil-cement is economical to install, which means savings and value for our customers. In addition, many blocks of soil-cement streets can be completed in a single day. This is a vital factor to us in maintaining land development and construction schedules and in holding down paving costs.

"Just as important, these streets assure low maintenance costs. They stay solid and don't pothole or wash out at the edges. This means continuing economy for the community and for the property owners."

Taxpayers especially like soil-cement. Most of the materials cost nothing. The main ingredient is soil at the site—or old broken-up blacktop or gravel. Mixed with portland cement and water, rolled and topped with bituminous coating—the pavement's finished. Soil-cement can save tax money where you live, too! Soil-cement grows stronger year after year. It's the strongest pavement short of concrete.

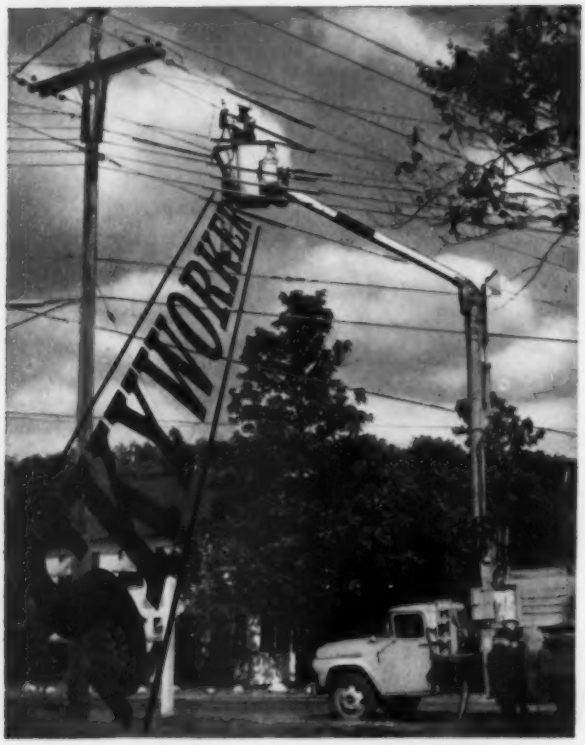


PORTLAND CEMENT ASSOCIATION
33 West Grand Avenue, Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete

MODERN soil-cement

for
work aloft
up to
50 feet



MODEL 1044a

COMBINES GREAT HEIGHT WITH MANEUVERABILITY AND SAFETY

SKYWORKER model 1044a provides any working height above ground up to 50 feet. Horizontal rotation of the turret thru 400° gives the unit wide lateral movement. The lower boom unfolds 135° to offer greater ease in reaching the most difficult work positions. / SKYWORKER safety features: work platform and the upper boom possess high dielectric strength . . . the leveling system insures a level work platform under all conditions . . . dual controls at the work platform and vehicle deck . . . the hydraulic system is fail-safe . . . two stabilizing outriggers provide absolute stability. / SKYWORKER now offers, as optional equipment, the very best fibre glass boom obtainable: a boom that provides exceptionally high dielectric strength for the protection of crewmen aloft and on the ground. / SKYWORKER model 1044a has the heavy-duty ability to bring new efficiency and safety to work at junction poles, splicing aerial cable in mid-span, work on outrigged cross-arms, and the toughest emergency jobs. / Write or telephone today for complete technical information and purchase plans.

HUGHES-KEENAN DIVISION
U.S. Air Conditioning Corp.
P.O. Box 360 Delaware, Ohio Telephone 363-1231

aged to play a more active part in the conduct of refuse disposal, water supply and sewerage services?

Superficial observation indicates that there is an increasing number of private water-supply and sewage disposal systems being operated with apparent success in areas where an existing governmental entity was either unable or unwilling to provide such services. And, of course, we have for comparative purposes such long-time examples of private enterprise operating the sewerage facilities of Atlantic City, N. J., water service at Indianapolis, Ind., and refuse-disposal landfills in San Francisco, to name only a few.

Looking toward the new frontiers it would be of more than academic interest to examine the potentialities and limitations of private enterprise in the conduct of certain community services. One might hope, therefore, that the long-range aspirations of the APWA Research Foundation will encompass matters of this kind.

Meantime, the association and its investigators are faced with the immediate task of listing and assessing opportunities for research effort. Your ideas would be most welcome. They can be addressed either to Samuel S. Baxter, chairman of the Research Foundation or to Robert Bugher, executive director, American Public Works Association, 1313 East 60th St., Chicago 37, Ill. □□□

Engineering Notes

Ordinance Covers Removal of Snow and Ice from Sidewalk Areas

An ordinance passed in April, 1961, by Abington Township, Pa., and sent to us by Edmund A. Bitting, Township Engineer, spells out precisely the requirements for clearing sidewalks by property owners. Following Section 1, which is the title, pertinent provisions are:

Section 2—Definitions: The following words, terms, and phrases as used in this Ordinance shall have the meanings given herein. When not inconsistent with the context, words used in the singular include the plural, and words in the plural include the singular, and words used in the present tense include the future. The word "shall" is always mandatory.

A. Person or Persons shall mean any person or persons, male or female, corporation, partnership, association, company, individual, owner, occupant, lessee, tenant or any organization.

B. Public Place shall mean any street, road, highway, avenue, lane, place, way, alley, footpath, sidewalk or park, within the limits of the Township.

C. Board of Commissioners shall mean the Board of Township Commissioners, Department of Public Works, Department of Public Safety, the Township Manager/Secretary, Chief of Police, Township Engineer or their authorized representative.

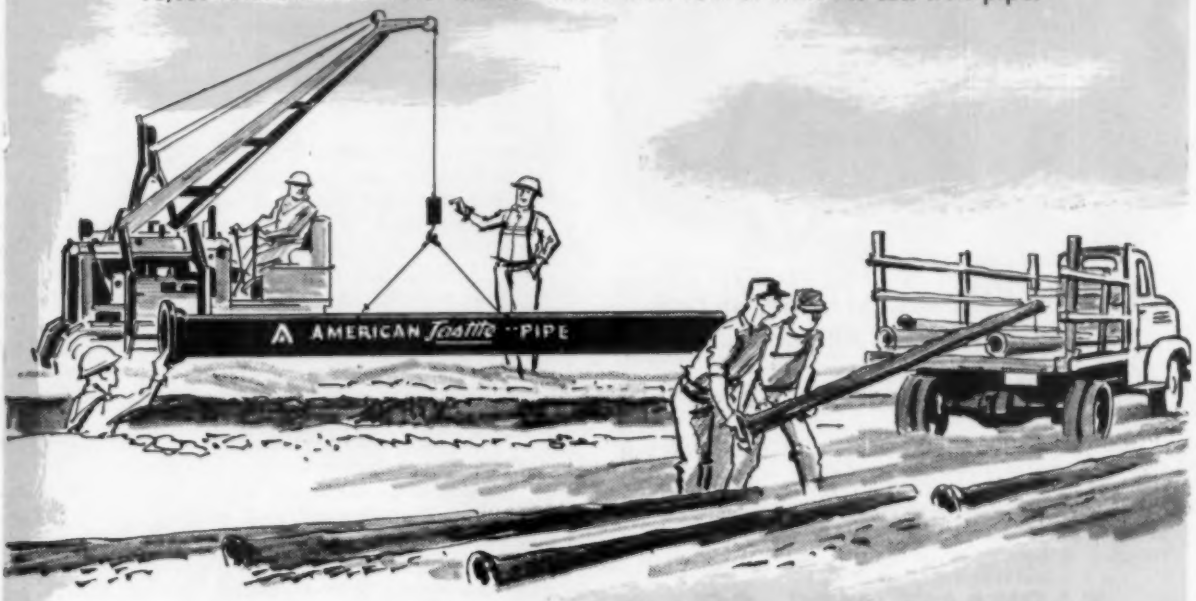
D. Sidewalk Area shall mean the area between the curb line and the side of the right-of-way, in any public place.

E. Sidewalk Pavement shall mean that part of the sidewalk area that is paved.

F. Footpath shall mean that part of the sidewalk area that is used by the public but in which there is no sidewalk pavement whatsoever.

PIPE FACTS

The 100 largest cities in the United States, surveyed recently, have more than 95,000 total miles of water mains — more than 90% of which is cast iron pipe!



DO YOU KNOW that when larger distribution mains are needed, the smaller mains can be reclaimed for years of additional service...if they are cast iron?

In Reading, Pa., for example... seven miles of cast iron pipe was taken up and relaid – saving about $350,000. Rarely, if ever, is composition pipe taken up and re-used.

DO YOU KNOW that cast iron pipe is designed to withstand expected water hammer shocks which can burst weaker mains? In tests, it required 3,400 psi water pressure to burst 6" Class 150 AMERICAN pipe. Composition pipe of similar size and class failed at 770 psi.

DO YOU KNOW that industry requires large volumes of water...and it must be economical? For most new industrial plants, water is the most important natural resource needed. In the long run, cast iron pipe delivers water cheapest of all.

DO YOU KNOW that the AMERICAN Fastite Joint requires no calking? Its only joint component is a dual hardness, easily-inserted, double-sealing rubber gasket. A minimum of labor and equipment is needed to install Fastite pipe...and the extra minutes saved soon total up to additional dollars saved in installation costs.

*Patented conductive gasket

AMERICAN CAST IRON PIPE COMPANY
BIRMINGHAM ALABAMA

for **Fast, Efficient Spreading of Bulk Chemicals** for snow and ice control.

This is **your most Economical** unit. You save: by **lower initial cost;** by using **less material;** by **lower maintenance costs.**

"Scotchman" Spreader, Model SS7V3, gives you **one-man, cab control.** Blows salt on in wide, "bird-shot" melting pattern . . . **you use less salt.** The dump body mounted **"Watchman Hopper"** . . . either 3 cu. yd. or 5 cu. yd. . **gravity-feeds salt to spreader,** without running with elevated body

TARRANT MFG. CO.

28 Jumel Place, Saratoga Springs, N.Y.

REMOVE SNOW FASTER

with MONARCH

Power Hydraulic Controls

Don't delay! Now, before winter comes, install a Monarch Power Hydraulic Control on your snow removal equipment. Instant snow plow action—raise, hold or lower—right from the cab with the flick of the wrist. Thousands in use!

A Monarch Control can be quickly installed. See your dealer. Write for illustrated folder.

MONARCH ROAD MACHINERY COMPANY

1363 Michigan St., N.E., Grand Rapids 3, Mich. U.S.A.

Section 3—Duties of Property Owners: It shall be the duty of the owner, or if he be not in residence, the occupant, lessee, tenant, or person having charge of any building, building lot, piece of ground or parcel of real estate in the Township of Abington, abutting upon any public place to remove or cause to be removed all snow and ice from the sidewalk pavement, or established footpaths, in front of or adjacent to such premises to a width of not less than three (3) feet, within twenty-four (24) hours after such snow or ice shall have fallen or accumulated thereon.

Section 4—Method of Snow and Ice Removal: A. Snow or ice removed from sidewalk areas shall be placed on the person's property.

B. If there shall be an excessive amount of snow or ice and there is no longer any place on the person's property to shovel the snow, then it may be placed along the curb line, but not in the street.

C. It shall be unlawful for any person to throw or put, or cause to be thrown or put any snow or ice into any public place in the Township while clearing driveway approaches unless the same shall be broken up and spread evenly over the surface of such public place.

D. At corner properties snow shall be cleared to enable pedestrians to cross the intersection.

E. Should the snow and ice on the sidewalk pavement, or footpath, be frozen so hard that it cannot be removed without injury to the pavement or damaging the base of the footpath, the person having charge of the snow and ice removal, may within the time specified in the preceding Section cause the sidewalk abutting or adjacent to such premises to be strewn and to be kept strewn with ashes, sand, sawdust, or some similar suitable material, and shall, as soon thereafter as the weather shall permit, thoroughly clean such sidewalks.

F. Fire hydrants shall not be covered.

Section 5 provides for penalties; Section 6 is the usual provision for validity; and Section 7 covers repeal of inconsistent ordinances. Fred F. Schaefer is Township Secretary.

Small Ohio Town Has a Municipal Water System

With a population of only 300, Amesville, Ohio, has its own independent municipal water system and treatment plant. It is probably the smallest community in Ohio to have a modern independent system; about 100 customers are served.

The system is completely automatic, operated and protected by liquid level controls built into the control panel. Three 10-inch wells provide the water supply. A Deming submersible pump is installed in each well. Two Deming centrifugals, one a stand-by, transfer the treated water to a 100,000 gallon storage tank which feeds the distribution system.

Use of Digester Gas in Richmond

The sewage treatment plant of Richmond, Va., in the year ending June 30, 1960, produced a total of 59 million cubic feet of digester gas. This was used as fuel in two engines, 350-hp. and 800-hp., which drive raw sewage pumps. Boilers for plant heating also use the gas. The gas engine driven pumps handled 96 percent of the sewage passing through the plant and the estimated saving resulting from the use of gas as fuel was $8,000.

EXTRA STRONG . . .
BETTER LOOKING . . .
LIGHTER WEIGHT!

Exclusive swaging and forming process prevents cross bars from turning, twisting, coming loose or falling out . . . provides greater strength and rigidity than gratings using obsolete methods of joining bars. Only Gary Galok Aluminum Gratings offer all these advantages:

High strength to weight ratio. Minimum deflection . . . easier to install.

Non-rusting and corrosion resistant. Ideal where chemical conditions prevail.

Can be used for decorative purposes, sun-shades, grilles, etc. Can be anodized in sunfast colors to blend with surroundings.

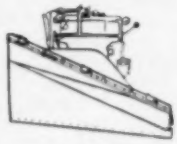
Available with serrated or plain bars—in all sizes to meet practically every requirement.

*Patent Pending

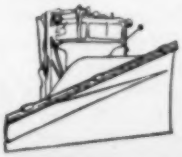
Write for Bulletin A759
Dept. J21, E. Seventh Ave., Gary, Indiana

ROCKWELL-STANDARD CORPORATION
Grating Division, Gary, Indiana

FRINK ROLL-OVER ELIMINATES DEADHEADING, *CUTS REMOVAL TIME*



rotates from left to right position in 15 seconds!



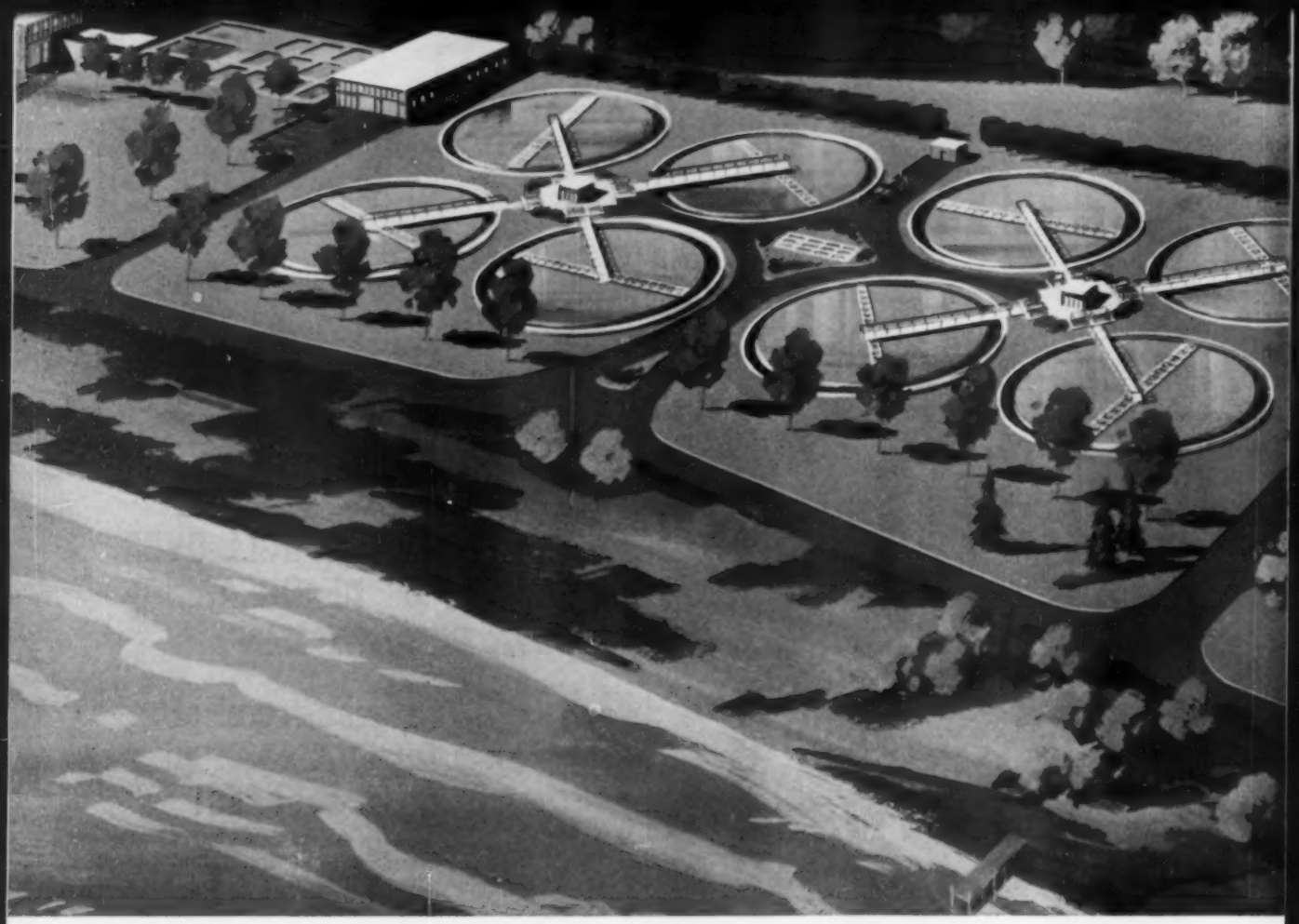
Here's why nothing matches a Frink Roll-Over Sno-Plow for clearing airports and thruways rapidly and economically.

The Roll-Over's unique rotating moldboard instantly reverses to plow either side . . . completely eliminates deadheading . . . cuts plowing time in half! Cab operated hydraulic controls raise, rotate and lower blade to plowing position in 15 seconds, even while truck is moving.

The Frink Roll-Over combines the higher speed and deeper snow handling qualities of a one-way with unmatched versatility. Snow can always be plowed with the wind, or towards any disposal area. And you can park "plow up," within the width of your truck.

For complete details on unique **Frink Roll-Over Plows** write Dept. PW1061

FRINK SNO-PLOWS, INC.
Engineers of Major Advances in Modern Snow Plow Construction
Frink Sno-Plows Inc., Clayton, New York
In Canada:
Eastern Steel Products Co., Preston, Ontario



New $9 million sewage features C-E Raymond Flash

Omaha selects C-E Raymond for second major installation

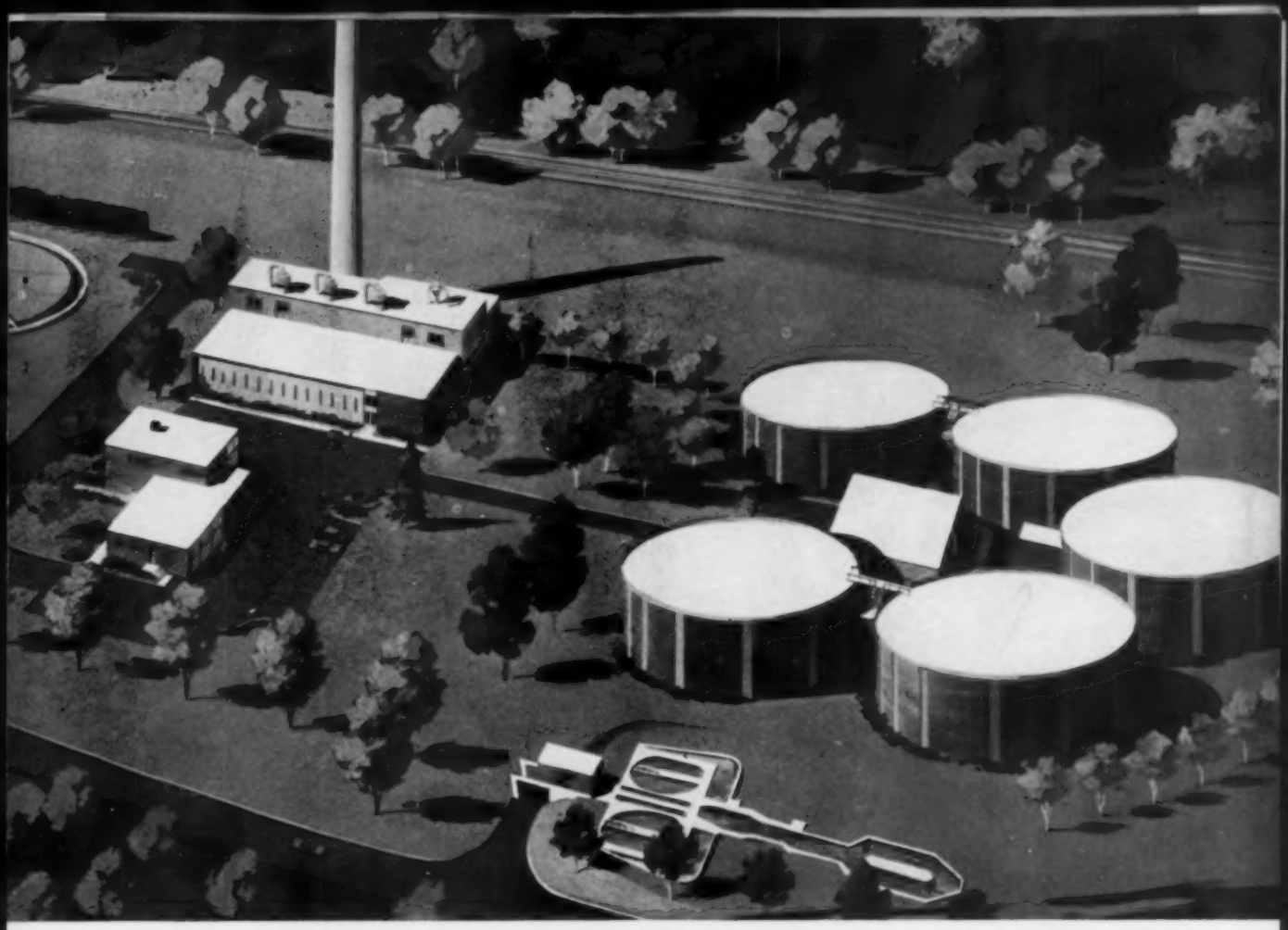
The City of Omaha recently ordered three C-E Raymond Incinerator Units for installation at its new Missouri River Sewage Treatment Plant now under construction. Henningson, Durham & Richardson are the Consulting Engineers.

This plant will serve an equivalent population of 2,000,000 and will have a dry weather flow of 70 mgd, and an influent capacity of 210 mgd. Treatment will be on a primary digested basis, but the C-E Raymond equipment is designed to incinerate either raw primary or digested primary sludge. The sludge will be burned to a sterile, clinker-free ash, but the plant will be equipped so that the solids from any one of the three C-E Raymond units can be dried for sale as a soil conditioner of low and uniform moisture content. This is the *only* system that permits both drying and incineration—separately or together—in any proportion.

This is the second Omaha plant for which C-E Raymond equipment has been chosen. The first plant, the 12-mgd Papillion Creek treatment plant, for which Henningson, Durham & Richardson were also consultants, has been in operation since 1959. This plant, containing a C-E Raymond Sludge Incinerator System proved the efficiency and economy of this equipment.

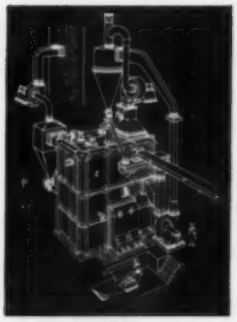
Our specialists will be glad to discuss with you or your consultants the many benefits this system can provide your community. For full information contact the C-E office nearest you.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;



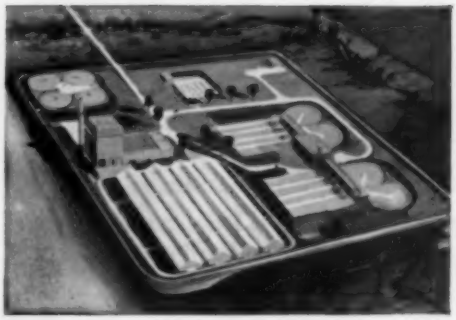
Hawkins-Talboe-Harlin (a Joint Venture), Omaha, Nebraska, are General Contractors for Omaha's new $9-million Missouri River Sewage Treatment Plant, architects rendering of which is shown above.

treatment plant for Omaha Drying and Incineration System



Right: Omaha's Papillion Creek treatment plant where C-E Raymond sludge disposal equipment has provided controlled drying, efficient incineration and excellent fly ash control since 1959. The Parsons Construction Company was the General Contractor.

Left: The C-E Raymond Flash Drying and Incinerator System provides maximum efficiency in processing filter cake — permits both drying and incineration, simultaneously or separately, in any proportion.



COMBUSTION ENGINEERING

C-329

General Offices: Windsor, Conn.

New York Offices: 200 Madison Ave., New York 16 • Raymond Division: 427 West Randolph St., Chicago 6, Ill.
Canada: Combustion Engineering-Superheater Ltd. • Western Office: 615 So. Flower Street, Los Angeles 17, Cal.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

USE IT, over and over. Republic Flexible Plastic Pipe is easy to cut and join . . . made of tough polyethylene to resist abrasion, acids, and alkalies. Use it for every purpose—to bring water in, or pump it out. Light, easy to handle. Get it through your Republic distributor, or send coupon.

NEW BILLET steel of highest quality, Truscon Re-Bars insure strongest bonding, positive anchoring for every type of concrete structure. Delivered fast, from facilities near you. Bundled, tagged for easy handling.

Steel

Strong, Modern, Dependable

GOOD...

long after the highway's "had it"!

Pavement above will probably be repaired many times during the long, long life of this vehicle underpass . . . but the Republic Sectional Plate that forms it won't cause any problems for anyone! It is made of strong, durable galvanized steel . . . corrugated for strength, and is bolted into arch design for added strength.

This is smart construction. The sectional plates are easily assembled by simple bolting . . . and once they're up, you're ready to backfill. No waiting for materials to "set up" . . . no additional permanent construction required.

Watch for a chance to use this idea. You'll save days at the start, and days at the finish! Ask your Republic supplier for information, or mail the coupon.

UNDERPASSES GO IN QUICKLY without costly forms wherever Republic Sectional Plates are used. Here, top plates are bolted in place by a crew working on a flatbed truck. High strength of sectional plate flexible construction provides great load carrying ability for long, maintenance-free service.

REPUBLIC STEEL

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

REPUBLIC STEEL CORPORATION
DEPT. PK-2720
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send information on these Republic "day-saver" Drainage Products:

- ☐ Sectional Plate Pipe
- ☐ Pipe Arch and Arches
- ☐ Corrugated Metal Pipe
- ☐ *FREE-FLOW* Sewer Pipe
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. . . also, send literature on:

- ☐ Truscon Re-Bars
- ☐ Plastic Pipe

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

WHY IT COSTS LESS TO OWN A CAT GRADER

Most motor graders *look* pretty much alike, no matter who makes them. They handle similar jobs, too, and it isn't always easy to *see* any big difference in the way they handle them. In fact, the manufacturer's suggested prices usually are not greatly different for machines of nearly equal specifications—regardless of the "deal" that may be offered a buyer. But *used* motor graders vary considerably in price. Why?

The Buyer Determines Price

A used machine is priced at what the buyer is willing to pay . . . it's a measure of what *he* thinks is left in a machine. So, with used equipment, the buyer sets the price. This is clearly demonstrated at used equipment auctions. A check of auction prices throughout the country shows, for example, that the Cat No. 12 Motor Grader brings substantially higher prices than comparable machines of other makes—as much as 80% more. (Only machines of the same age, same condition and with similar attachments were compared.) What makes a Cat Motor Grader more desirable than other makes?

A Feature That Affects Cost

Any machine is desirable if it is known to be dependable. This reputation can only be the result of true quality design and quality construction. The Cat oil clutch is a good example. It was designed and is built to give long, trouble-free life. But, how well does it do it? Let's examine the records of just one Caterpillar Dealer who has 161 oil clutch-equipped motor graders in his territory. His records show that in four years he has sold only $24.38 worth of parts for motor grader oil clutches! One machine in his territory went 2524 service meter hours without any work on the clutch. Many users report 2000 hours of service before the first adjustment. In 1000 hours of operation only about .0025 inch of wear can be expected—less than the thickness of a human hair. And, since all parts are constantly bathed in oil there is no need for lubrication maintenance. Less wear, less attention mean not only lower total repair costs but more time on the job . . . less down time. Of course, the oil clutch is just one example of many quality features in Cat Graders.

A Look at Total Cost Records

The cost records of private owners and governmental bodies show which machines cost less. For example, an Indiana county keeps individual cost records on their six motor graders, 14 trucks, three loaders and five tractors. Their records showed that a year-old No. 12 needed only a set of head gaskets and two spark plugs with $25 labor, while two newer graders of another make needed major engine repairs, new clutches and side shift linkage. One town in New Hampshire reports that in over 20,000 hours, their No. 12 has never had a breakdown that held up work more than three hours. Operating costs—24¢ per hour exclusive of fuel, oil and operator. Comparing a Cat No. 12 to another make (after 3½ years' service), the records of an Arkansas county showed a saving of $2478.57 in parts and labor for their No. 12.

What's in It for You

Others have proved that Cat Motor Graders cost less in the long run because they are built better in the beginning. Your Caterpillar Dealer has additional facts and figures on low-cost operation of Cat Graders in your area. Ask him for free Cost Record Books so that you can keep individual machine records on your equipment. Prove to yourself that it costs less to own a Cat Grader.

Caterpillar Tractor Co.,
General Offices, Peoria, Ill., U. S. A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

County Develops Master Plan for Water Supply and Sewerage

ALFRED A. ESTRADA
Executive Vice-President
and
ROBERT P. HEURICH
Engineer,
Albright & Friel Inc.,
Consulting Engineers,
Philadelphia, Pennsylvania

HISTORIC Bucks County, in eastern Pennsylvania adjacent to the City of Philadelphia and directly on the route between Philadelphia and New York, is coming to grips with its twin problems of water supply and waste disposal. One of the fastest growing areas in the country, it finds that only 50 percent of its population is served by public water systems, and only 40 percent by sewers.

Many areas of the county are experiencing difficulty in obtaining adequate water, and overflowing septic tanks are not uncommon. These conditions need correcting by furnishing adequate public facilities. The situation will be compounded by future home and industrial construction unless proper sanitary facilities are provided for them.

In the past, planning has been undertaken on a local basis by the boroughs and townships within the county. Such planning must necessarily consider only the requirements of the particular community, and regional considerations have been neglected. Since it is unfeasible for many municipalities to construct their own facilities, the county commissioners have concluded that it is necessary to plan on a county-wide basis, and retained the firm of Albright and Friel Inc. to develop a master plan. The study was administered by the Bucks County Planning Commission and the Bucks County Department of Health. Charles R. Witmer is chairman of the planning commission and Franklin C. Wood is Executive Director. For the health department, Dr. Raymond D. Tice is Chairman and Dr. William Meyer is Executive Director.

During the course of the study, the consultants reviewed preliminary determinations with a technical advisory committee appointed by the planning commission. This committee consisted of the Executive Directors of the planning commission and of the health department; James H. Allen, Executive Secretary, Interstate Commission on the Delaware River; Blair T. Bower, who was at that time the water resources engineer for the Delaware River Basin Advisory Committee; John T. Carson, Jr., President, Neshaminy Valley Watershed Association; Dr. James G. Coke, Executive Director, Philadelphia Metropolitan Area Study Commission; and George A. Elias, Regional Sanitary Engineer, Pennsylvania Department of Health. The committee supplied a broad perspective of the combined experience viewpoints of its members and contributed much to the value of the study.

The plan is developed for construction in stages, to meet the expected requirements for the years 1965, 1985, and 2010, as well as the ultimate development for those areas not expected to require facilities until after the year 2010. It provides for development of ground water sources as far as is practicable, and development of surface water supplies. It includes approximate sizes and locations of transmission mains and storage facilities. For waste disposal, the plan includes locations of sewage treatment plants and approximate capacities, trunk sewers and major pumping stations.

Existing Facilities

The first step was to collect and evaluate data on existing facilities. This was done with the collaboration of the staff of the planning commission. Questionnaires were first sent to the owners of all known water supply and sewerage systems. In order to clarify the answers and obtain additional data, it was necessary to follow up the questionnaires by interviewing representatives of most of the agencies personally. Additional information was obtained from the Regional Sanitary Engineer of the Pennsylvania Department of Health, from the Middle Department Association of Fire Underwriters and from other consulting engineers.

In analyzing the dependable capacity of the existing water systems, allowances were made for decreased well yields during drought periods, wells out of operation and inadequate storage capacity. Sewage treatment plants were evaluated according to the equivalent population they could handle. In some cases, existing interceptors were investigated to determine how much additional flow they could carry.

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The second step in the study was to determine future requirements. To obtain population projections, the county contracted with the Bureau of Economic and Business Research of Temple University. The work was done by Dr. Jack Gelfand under the general direction of Dr. John Adams, Director of the Bureau.

Population Projections

In order for the projections to serve their maximum usefulness, the county was divided into areas smaller than municipalities and along lines coinciding with boundaries of proposed water and sewerage regions, as far as practical. There was no way, in the early stages of the study, to know where the outlines of proposed water supply regions would fall. However, it was known that the sewerage regions would follow drainage basin limits. Therefore outlines of the population sub-areas were laid out to conform to drainage basin outlines. In order that the projections could be tied to existing population data, the boundaries of the sub-areas were adjusted to coincide with the boundaries of the county's "enumeration areas", which are subdivisions of U.S. Census tracts and for which current population data were available. Thus the county was divided into 96 population sub-areas.

In making the projections, Dr. Gelfand started with 1960 as a base year. The planning commission maintains accurate year-by-year estimates of population through its census department, which assembles data collected by local school districts. At the time the projections were made, population estimates up to the year 1958 were available. These were projected to the year 1960 by the planning commission and after the study was completed, these projections showed a close agreement with the 1960 U. S. Census.

For the 50-year projections, the 96 sub-areas were grouped into 12 analysis regions, whereby sub-areas which were judged to have equal growth potentialities were put into the same analysis region. Then growth rates were estimated for each of the analysis areas, primarily taking into account such external factors as location, industrial development, existing and proposed transportation facilities, zoning regulations and present state of development. The growth rates were estimated by Dr. Gelfand in collaboration with staff members of the planning commission who were familiar with the social structure and economic development of the county.

Having thus obtained projections for each of the 12 analysis areas, Dr. Gelfand then broke them down to give projections for each of the 96 sub-areas. The resulting figures indicate a growth in the total county from 315,000 in 1960 to 828,000 by the year 2010, an increase of 165 percent.

Water Demands and Sewage Flows

Per-capita rates of water use and of sewage flow had to be estimated in order to determine total quantities. A study was made of present water use and sewage flows in Bucks County and of requirements by other agencies. The per-capita water use and sewage flow is quite variable and depends upon a number of factors, among which are the economic status of the population, whether or not there are water meters installed, and whether or not there are sewers available. A value often used in design is 100 gallons per capita per day.

In the Delaware River Basin study just completed by the Corps of Engineers, preliminary data showed that per-capita water use in the Delaware Basin in 1955 varied from 111 gallons per day in rural areas to 151 gpd in the metropolitan areas. These values included municipally-supplied industrial use. It has been found by the Corps of Engineers and by others that per-capita rates of water use are related to per-capita personal income. On this basis, per-capita rates of water demand in the various regions of the Delaware Basin were estimated by the Corps of Engineers to increase at rates varying from 0.7 to 1.0 percent per year.

Present per-capita rates of water use in Bucks County, excluding industrial use, vary in the different water systems from 30 to 101 gpd, with an average of 72 gpd. Per-capita sewage flow varies in the different sewerage systems from 43 to 100 gpd, with an average of 70, which is just about equal to the average water demand.

On the basis of these facts, the following criteria were adopted for the Bucks County plan:

1) For design purposes, a per-capita rate of 80 gpd for 1960 was assumed for both water demand and sewage flow. This includes domestic, commercial, and public, but not industrial.

2) The per-capita rate was assumed to increase at the rate of one percent per year. This gave a value of 100 gpd in the year 1980 and 130 gpd in the year 2010.

An allowance was made for industrial water demand and sewage flow based on the estimated area of developed industrial land at the rate of 750 gpd per acre.

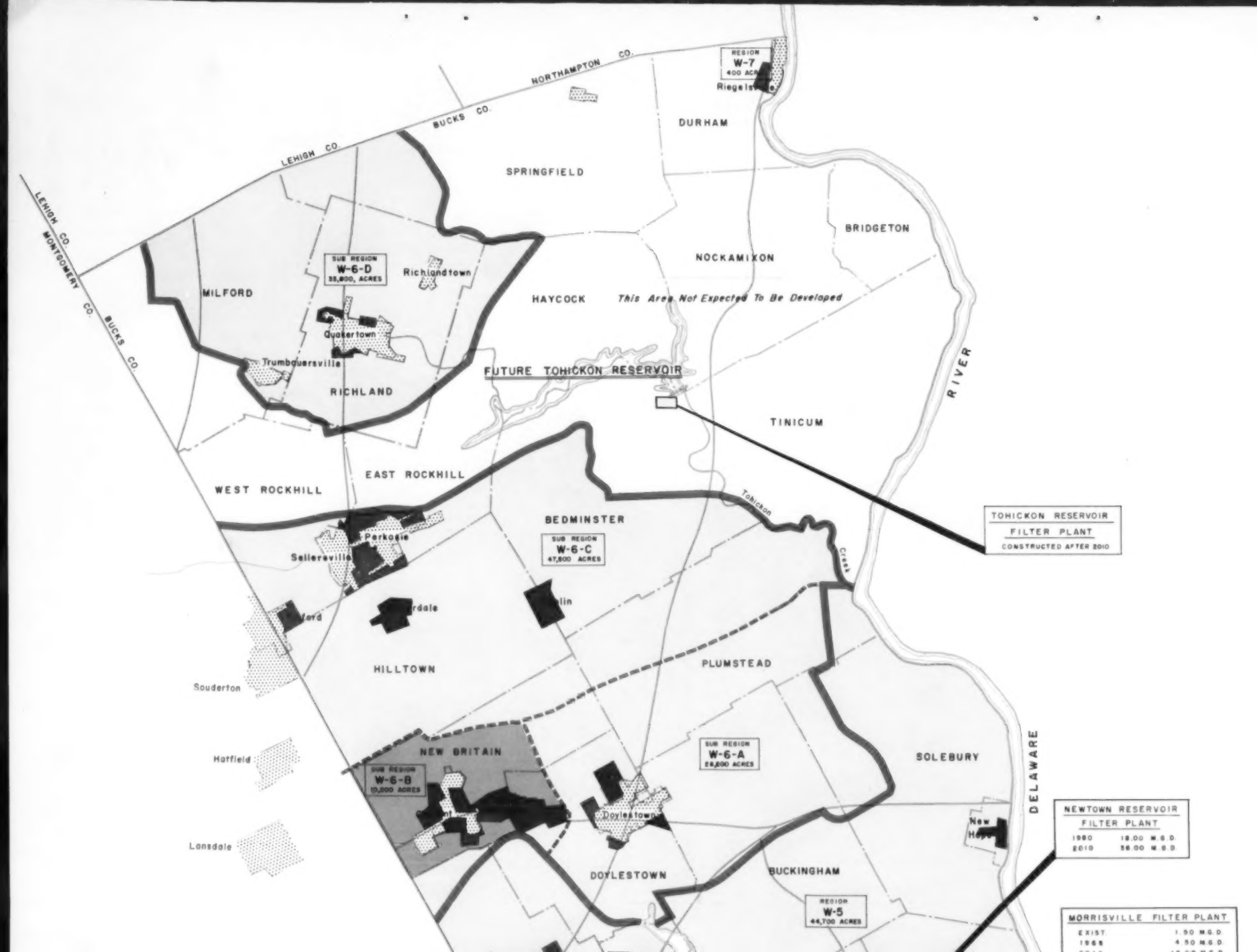
An important aspect of the study was the development of a time schedule for providing the required facilities. The times at which the various areas in the county are estimated to require services are shown on Figures 1 and 2.

The factors which determine whether an area is to be provided with public sanitary facilities are very complex. The answer depends on technical considerations such as geology, topography, and surface stream patterns. In addition there are economic considerations which affect the people's ability and desire to pay for public systems. Such factors would involve detailed studies which would be beyond the scope of this study. However, population density is one factor which may be used as a general criterion. Heavy densities result in greater need for public facilities, and at the same time bring about lower per-capita costs.

On the basis of a study of sewerage systems which have been designed and constructed by Albright and Friel Inc., it was determined that a density of 5 persons per acre was about the minimum density which results in economically feasible sewer rentals. Therefore, in the study, it was assumed that sewer systems would be provided in any sub-area at the time that its population reached an average density of 5 persons per acre.

For water, a density of three persons per acre was used as the point at which public facilities could be economically provided. The reason for using a lower density for water than for sewerage is because it is more economical to construct smaller water systems using well water supply than it is to construct small sewer systems with costly sewage treatment plants.

The basic plan is to provide water and sewage facilities for any area at such time as its population reaches the limits specified above. This was done for each of the 96 sub-areas described above. In addition, some smaller sub-divisions were included, and sewerage would be provided for some areas now experiencing septic tank difficulties,

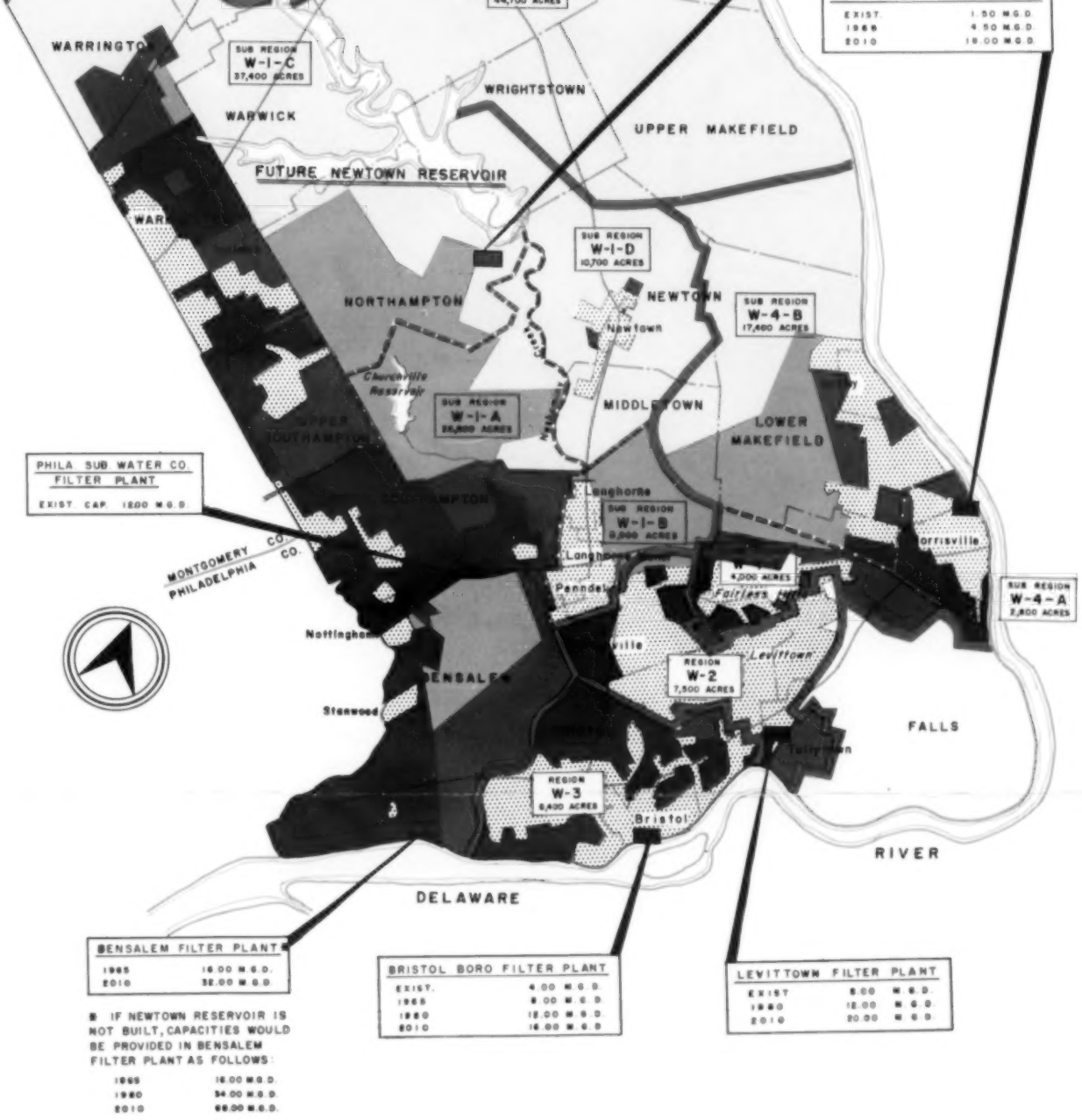

NORTHAMPTON CO.
BUCKS CO.
LEHIGH CO.
LEHIGH CO.
MONTGOMERY CO.
BUCKS CO.
REGION W-7 400 ACRES
Riegelsville
DURHAM
SPRINGFIELD
BRIDGETON
NOCKAMIXON
SUB REGION W-6-D 35,600 ACRES
Richlandtown
MILFORD
HAYCOCK
This Area Not Expected To Be Developed
Quakertown
Trumbauersville
RICHLAND
FUTURE TOHICKON RESERVOIR
DELAWARE RIVER
TINICUM
WEST ROCKHILL
EAST ROCKHILL
BEDMINSTER
SUB REGION W-6-C 47,500 ACRES
Tohickon Creek
TOHICKON RESERVOIR
FILTER PLANT
CONSTRUCTED AFTER 2010
Perkasie
Sellersville
HILLTOWN
PLUMSTEAD
Souderton
Hatfield
Lansdale
NEW BRITAIN
SUB REGION W-6-B 19,200 ACRES
SUB REGION W-6-A 28,200 ACRES
SOLEBURY
Doylestown
NEWTOWN RESERVOIR
FILTER PLANT
1980 18.00 M.G.D.
2010 36.00 M.G.D.
DOYLESTOWN
BUCKINGHAM
REGION W-5 44,700 ACRES
MORRISVILLE FILTER PLANT
EXIST. 1.50 M.G.D.
1968 4.50 M.G.D.

WATER SUPPLY FACILITIES

GENERAL PLAN

- AREA PRESENTLY SERVED BY WATER LINES
- AREA TO BE SERVED BY 1965
- AREA TO BE SERVED BY 1980
- AREA TO BE SERVED BY 2010
- AREA TO BE SERVED ULTIMATELY
- EXISTING WATER FILTRATION PLANT
- FUTURE WATER FILTRATION PLANT
- REGION LIMIT
- SUB REGION LIMIT

WELL FIELD LOCATIONS NOT SHOWN



BENSALEM FILTER PLANT

1965	16.00 M.G.D.
2010	32.00 M.G.D.

BRISTOL BORO FILTER PLANT

EXIST.	4.00 M.G.D.
1965	8.00 M.G.D.
1980	12.00 M.G.D.
2010	16.00 M.G.D.

LEVITTOWN FILTER PLANT

EXIST	8.00 M.G.D.
1980	12.00 M.G.D.
2010	20.00 M.G.D.

@ IF NEWTOWN RESERVOIR IS NOT BUILT, CAPACITIES WOULD BE PROVIDED IN BENSALEM FILTER PLANT AS FOLLOWS:

1965	16.00 M.G.D.
1980	24.00 M.G.D.
2010	48.00 M.G.D.

MASTER PLAN FOR WATER SUPPLY AND SEWAGE FACILITIES

BUCKS COUNTY PLANNING COMMISSION

ALBRIGHT & FRIEL INC CONSULTING ENGINEERS
PHILADELPHIA PENNSYLVANIA

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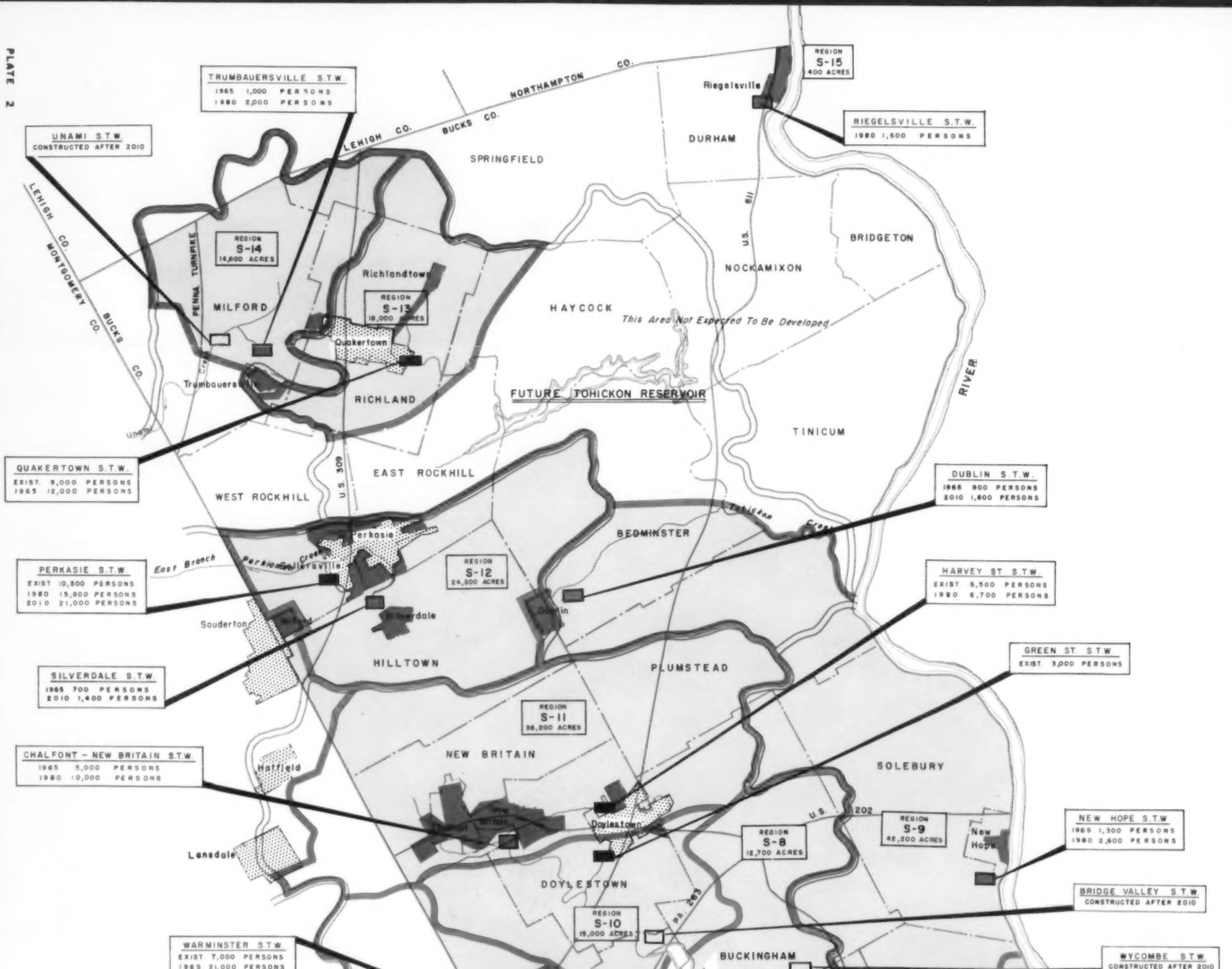
MILES

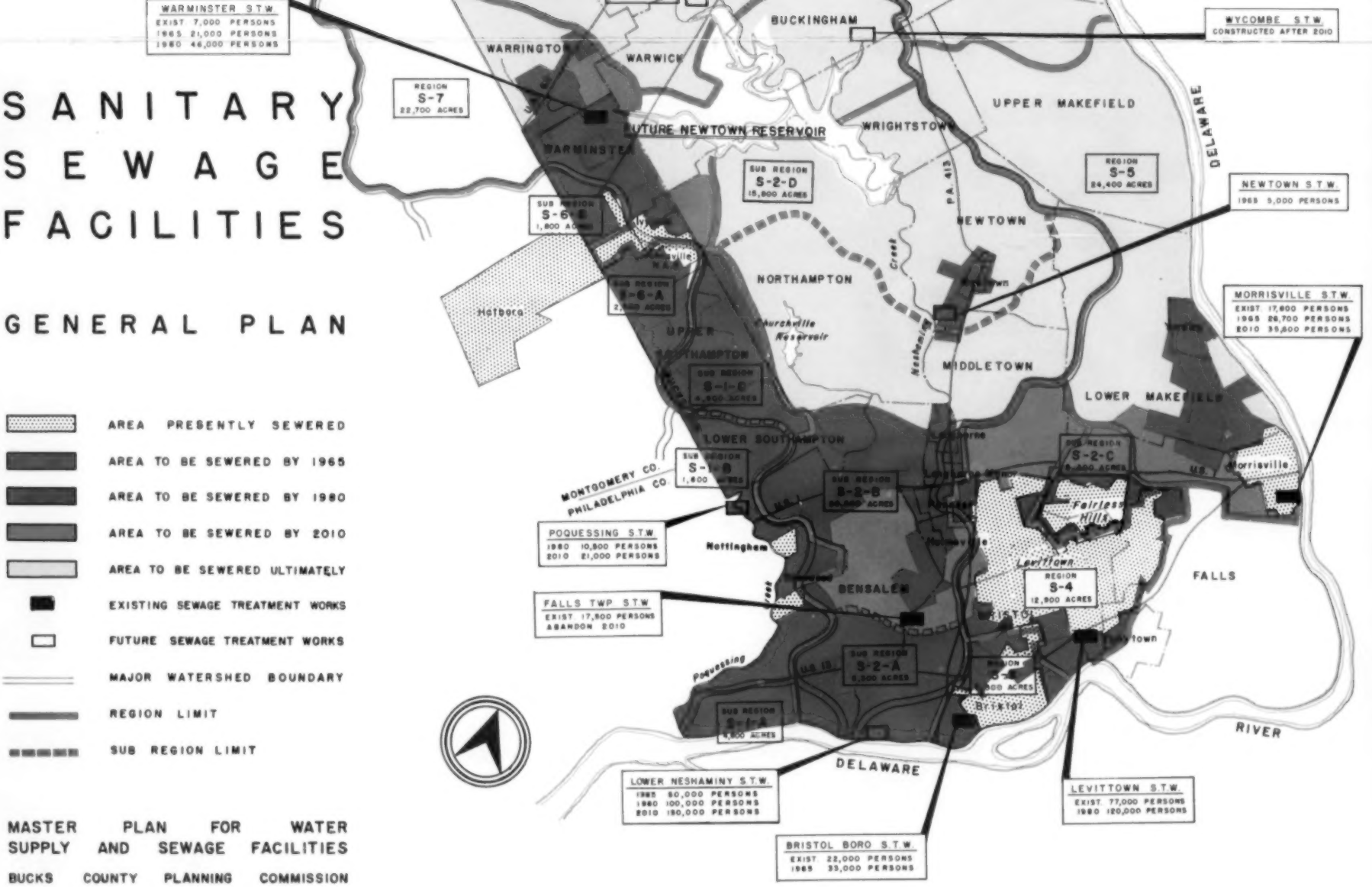
PLATE 1

PLATE 2


TRUMBAUERSVILLE S.T.W.
1965 1,000 PERSONS
1980 2,000 PERSONS
UNAMI S.T.W.
CONSTRUCTED AFTER 2010
QUAKERTOWN S.T.W.
EXIST. 9,000 PERSONS
1965 12,000 PERSONS
PERKASIE S.T.W.
EXIST. 10,500 PERSONS
1980 15,800 PERSONS
2010 21,000 PERSONS
SILVERDALE S.T.W.
1965 700 PERSONS
2010 1,400 PERSONS
CHALFONT - NEW BRITAIN S.T.W.
1965 5,000 PERSONS
1980 10,000 PERSONS
WARMINSTER S.T.W.
EXIST. 7,000 PERSONS
1965 21,000 PERSONS
REGION S-14 14,600 ACRES
REGION S-13 18,000 ACRES
REGION S-12 24,500 ACRES
REGION S-11 36,200 ACRES
REGION S-10 15,000 ACRES
REGION S-8 12,700 ACRES
REGION S-9 42,200 ACRES
REGION S-15 400 ACRES
RIEGELSVILLE S.T.W.
1980 1,500 PERSONS
DUBLIN S.T.W.
1965 900 PERSONS
2010 1,800 PERSONS
HARVEY ST. S.T.W.
EXIST. 5,500 PERSONS
1980 6,700 PERSONS
GREEN ST. S.T.W.
EXIST. 3,000 PERSONS
NEW HOPE S.T.W.
1965 1,300 PERSONS
1980 2,600 PERSONS
BRIDGE VALLEY S.T.W.
CONSTRUCTED AFTER 2010
WYCOMBE S.T.W.
CONSTRUCTED AFTER 2010
FUTURE TOHICKON RESERVOIR
This Area Not Expected To Be Developed
NORTHAMPTON CO.
LEHIGH CO.
BUCKS CO.
MONTGOMERY CO.
SPRINGFIELD
DURHAM
RICHLAND
MILFORD
HAYCOCK
NOCKAMIXON
BRIDGETON
TINICUM
EAST ROCKHILL
WEST ROCKHILL
BEDMINSTER
HILLTOWN
PLUMSTEAD
NEW BRITAIN
SOLEBURY
DOYLESTOWN
BUCKINGHAM
Riegelsville
Richlandtown
Quakertown
Trumbauersville
Perkasie
Souderton
Silverdale
Dublin
Doylestown
New Hope
Lansdale
Hatfield
PENNA. TURNPIKE
U.S. 611
U.S. 309
U.S. 202
PA. 263
Tohickon Creek
East Branch Perkiomen Creek
Perkiomen Creek
Lehigh River

SANITARY SEWAGE FACILITIES

GENERAL PLAN



- AREA PRESENTLY SEWERED
- AREA TO BE SEWERED BY 1965
- AREA TO BE SEWERED BY 1980
- AREA TO BE SEWERED BY 2010
- AREA TO BE SEWERED ULTIMATELY
- EXISTING SEWAGE TREATMENT WORKS
- FUTURE SEWAGE TREATMENT WORKS
- MAJOR WATERSHED BOUNDARY
- REGION LIMIT
- SUB REGION LIMIT

MASTER PLAN FOR WATER SUPPLY AND SEWAGE FACILITIES

BUCKS COUNTY PLANNING COMMISSION

ALBRIGHT & FRIEL INC. CONSULTING ENGINEERS
PHILADELPHIA PENNSYLVANIA

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MILES

although the over-all density may be light in such areas.

Water Supply Program

Bucks County has potential sources of water supply in the form of ground water, surface water from the Delaware River, and surface water from impoundment on smaller streams. At present, most of the 25 water systems utilize ground water, but about 60 percent of the total water supplied in Bucks County comes from three filter plants located on the Delaware River. A fourth filter plant, on Neshaminy Creek is owned by the Philadelphia Suburban Water Company, and primarily serves a developed area within the company's charter area outside of Bucks County. Only small areas within Bucks County are served by this plant.

For future growth, wells should
2010.
meet all requirements until the year
be used, rather than surface water, wherever the yield is adequate and the quality satisfactory, because of the lower cost of ground water development. In central and upper Bucks County, where the population density is relatively light and where ground water supplies are fair to good, it is expected that well systems can be developed to produce yields which will be adequate to

In lower Bucks County, where population densities are heavier and
cated. These could be obtained by expanding the existing filter plants where ground water supplies are inadequate either as to quantity or quality, surface supplies are indi-
on the Delaware River (Bristol, Levittown, and Morrisville) and by constructing a new filter plant on the Delaware River in Bensalem Township.

Additional surface water could be obtained from two reservoirs which have been proposed by the Corps of Engineers and which are being considered for construction by the Pennsylvania Department of Forests and Waters. One reservoir would be on Neshaminy Creek near Newton and the other would be on Tohickon Creek. An alternative proposal for construction of a series of smaller reservoirs is also under consideration for Neshaminy Creek. Water from Neshaminy Creek could be used immediately, but it is assumed that the reservoir or reservoirs will not be built before 1980. Water from Tohickon Reservoir would not be needed until after the year 2010. These reservoirs would not be economically feasible if built solely for water supply purposes. However, if they were built primarily for recreation or other uses, then they would be of value for water supply as an additional use.

If these reservoirs are not built as assumed, the plan could be revised accordingly. Additional capacity could be provided in the Bensalem filter plant to take the place of the Newtown Reservoir. An intake and pumping station could be provided on the Delaware River near the mouth of Tohickon Creek to take the place of Tohickon Reservoir.

Table 1 gives a summary of water supply data. These figures indicate that by the year 2010 it will be necessary to supply water to 340 percent of the people now served, and that total supply capacity will have to be 430 percent of the present capacity.

Table 1—Summary of Water Supply Data

	Existing	Estimated for Future		
	1960	1965	1980	2010
Population Served				
Well Water	117,000	158,900	223,200	235,700
Delaware River Water	80,500	138,000	189,700	311,200
Water From Newtown Reservoir	None	None	52,200	123,900
Total	197,500	296,900	465,100	670,800
Number of Active Wells and Springs	119	162	225	291
Total Dependable Capacity, MGD	17.54	27.59	44.54	61.40
Number of Filtration Plants	7	9	10	10
Total Capacity, MGD	25.50	37.16	63.28	123.22
Total Effective Storage, MG	12.88	23.18	44.68	70.28
Transmission Mains				
Range of Sizes (Dia. in Inches)	12-20	12-24	12-36	12-36
Total Length (Feet)	230,000	410,000	655,000	1,000,000

Table 2—Summary of Sewerage Data

	Existing	Estimated for Future		
	1960	1965	1980	2010
Bucks County Population Served by Sewers	128,300	247,100	395,400	513,700
Number of Sewage Treatment Works in Bucks County	10	17	19	18*
Total Design Capacity of Sewage Treatment Works to Serve Bucks County (including capacity to be provided in plants located outside of Bucks County (persons)	172,500	319,900	532,200	595,900
Trunk Sewers				
Range of Sizes (Diameter in Inches)	12-36	12-54	12-54	12-54
Total Length (Feet)	180,000	400,000	454,000	541,000

*One plant to be abandoned by the year 2010.

Sewerage Program

There are presently 10 sewage treatment plants in Bucks County. Seven of them are located on small streams and handle 40 percent of the sewage. The other 60 percent is treated in three plants located on the Delaware River (Bristol, Levittown and Morrisville).

In the future program, the Delaware River will continue to be the principal receiver of treated sewage so that by the year 2010, 75 percent of the sewage would be treated in plants along the river. It is expected that the existing plants along the river will be expanded and a new major plant built along the river near the mouth of Neshaminy Creek. Other plants would be built on smaller streams to serve developed areas inland from the Delaware River. All of the plants would provide secondary treatment.

The service areas would generally follow watershed boundaries except in a few cases where the nature of the development is such that pumping across a divide would be more economical. Sewage trunk lines naturally follow streams, and sew-

(*Continued on page* 208)

Timely Maintenance

A VITAL HIGHWAY NEED

BERTRAM D. TALLAMY
Consulting Engineer
Washington, D.C.

DO NOT PUT OFF highway maintenance! If it is not undertaken at the right time enormous loss of public funds, and private too, is certain to result. This is axiomatic in any case where work and wear and mother nature take their toll. The whole destructive pattern brought about by neglecting to do the right type of maintenance at the right time is clearly illustrated by the dilemma in which George, an all-too-often typical young man, found himself one day.

As the saying goes, it was raining cats and dogs. The wind was blowing the rain almost horizontally. George and his wife were running helter-skelter emptying pans of rain water which was leaking into almost every room in the house.

This was an unusual storm, but not of the freak kind which happens once in a lifetime. It was just a heavy storm that occurs once or twice a year. George was caught flatfooted because he had completely neglected putting new shingles on the roof. As a result, wallpaper and plaster were ruined, baseboards would be warped out of place and there would probably be short circuits because of water following along the electrical conduits. Instead of merely reshingling the house, George will now be confronted with major repairs to the interior as well. If they had only budgeted their income to take care of the reshingling on time. Now they are confronted with a *serious* problem, possibly the loss of their home.

● **CARAVAN arrangement protects Profilometer with warning trucks a few hundred feet apart and state trooper car between trucks. Caravan speed is about 5 miles/hr.**

This is a deplorable situation, yet it happens countless times. George had patched his roof time and time again but he failed to reshingle even though long overdue. The heavy storm had caused rotted shingles to break loose and leaks to spring out all over the place.

Such unhappy experiences are not confined to people like George. His predicament is analogous to thousands of circumstances which result in unnecessary waste and expenditure upon the part of both private and government interests. Probably no greater example of unnecessary reconstruction and abandonment, and consequent new construction involving enormous public expenditure, exists than in the highway field.

As Federal Highway Administrator during the Eisenhower administration, Bertram D. Tallamy was instrumental in launching the massive Interstate highway program enacted by Congress in 1956 which is now assured of scheduled completion by the new Federal legislation enacted this year. The AASHO Road Test conducted by the Highway Research Board near Ottawa, Illinois, in which the Bureau of Public Roads was an active technical and financial participant, was conducted and substantially completed during his term of Federal service.

Now a private consultant with Washington offices just across the street from his former headquarters, Dr. Tallamy is turning his attention and his wealth of talent and experience toward yet another vital facet of our national highway needs—sound, long-range maintenance programs.

The editors of PUBLIC WORKS are proud to present this first of a series of articles by one of the highway engineering profession's most respected members.

Inadequate Funds

Highway maintenance money is universally inadequate. The relatively meager funds available for that purpose must first go to keeping the road open. Snow has to be removed, ice controlled, clogged ditches and culverts opened, traffic lights kept operating. The next big bite from the maintenance budget goes to pouring joints and cracks and patching roadway surfaces. Some painting of steel is done, but often neglected far too long. Then, of course, more funds must go for signing, shoulder work and mowing. All too frequently however, the undersealing, leveling of the pavement, surface treatment and resurfacing are on an expedient basis. It is done too little or too late, or not at all. Underdraining which has obviously become necessary to eliminate ground water conditions and

unavoidable surface water penetration is not installed, thus water freezes in winter and heaves the pavement out of shape and causes it to pump, to rut or pot hole in the spring.

These conditions are not an indictment of the maintenance men in the various highway departments, whether they be city, county, state or village. They are doing the best they can with the money they have, but all too often they are treated as step-children by everyone. The glamour is in building new roads and new bridges and, like a magnate, this draws the majority of highway monies for that purpose. Proper long-range planning of expenditures for heavy maintenance work and the implementing of such a plan are now taking on still further important significance because of the construction of the National System of Interstate and Defense Highways. The terrific concentration of traffic, particularly truck traffic, on this one system increases the problem of wear and fatigue on those highways and bridges. Failure to maintain properly these enormously expensive highways would result in a great waste of both public and private resources.

If a state fails to look ahead and realistically plan its budgeting of both capital and heavy maintenance expenditures, either the highways will not be properly maintained, or the capital budget in some years of large expenditures for heavy maintenance will be drastically cut, or new taxes or borrowings on the part of the state will become necessary. Any one of these would be unfortunate, but neglect of the Interstate system would be by far the worst. Not only would ultimate expenditures on that system be vastly increased, as in the case of George's neglect to shingle his roof, but private losses would be beyond comprehension.

Private Investments

Everywhere you look today you see new industries, multi-million dollar commercial establishments, and huge residential developments springing up like magic around the Interstate system. This is true because these developments require the quick, efficient and safe transportation the year around that the Interstate system affords. Serious reduction in the efficiency of that system through inadequate maintenance would equally cut the economic value of those enormous private investments made in justifiable expectation that the efficiency of these highways would be continuously maintained in the years ahead.

With ten thousand miles of the Interstate system already opened to traffic, and the many other thousands of miles of vital heavy duty roads on the Federal aid systems and in metropolitan areas requiring equal attention, this is not a problem of the future; it is one which we are confronted with today.

The toll roads authorities, particularly, have been endeavoring to meet this situation and have done quite well. They generally make yearly studies showing the condition of the structures, pavement and other highway facilities and then, based upon experience, estimate their future maintenance expenditures and plan to meet them through savings from revenues or borrowings. Now, however, an extremely important new tool is available. The valuable findings developed by the Ottawa AASHO test road research project, conducted by the Highway Research Board, now make it possible to forecast more scientifically the times when heavy maintenance expenditures will be required.

Thruway Study

Early this year, the New York State Thruway Authority engaged the writer to prepare a long-range heavy maintenance program extending through 1975 for their 558-mile express highway system. This also included the development of a proposed financing plan to meet those expenditures when required. In advancing this study, much of the Ottawa test road precedure and formulae have been put to use. As in the case of investigating the effect of single truck load repetitions on the AASHO test road loops, careful visual investigations are being made of every foot of the New York State Thruway system, following the same techniques used by the test road personnel. Likewise, the present slope variance is being obtained by taking profilo-meter readings. By combining the results of the visual inspection and the slope variance we can obtain the present serviceability index, which is a function of the work done by the highway in carrying the traffic from its beginning to the time of taking the reading.

Also, it is possible to develop the theoretical number of mixed loads which would have produced the serviceability index at the time of

● **FATIGUE potentials under tractor-trailer loading are analyzed. Strain gauges establish range of stress variation. Recording equipment is at right.**

● **STRAIN recording instruments; notes are made of position and type of vehicle on bridge.**

the survey. With this information, and the actual number of mixed loads, and estimated future traffic, it becomes practical to determine the time when a serviceability rating will be reached below which it is not desirable to go.

Of course, there are a number of additional factors that weight the results which would be obtained through straight application of the test road data, such as changes in rates brought about by certain heavy maintenance prior to the time of resurfacing.

It is also important to consider climatic differences between one section of a state and another, variations in depth of frost penetration, basement soils, ground water conditions and design variations. However, the basic themes developed by AASHO will apply to sections with generally similar conditions.

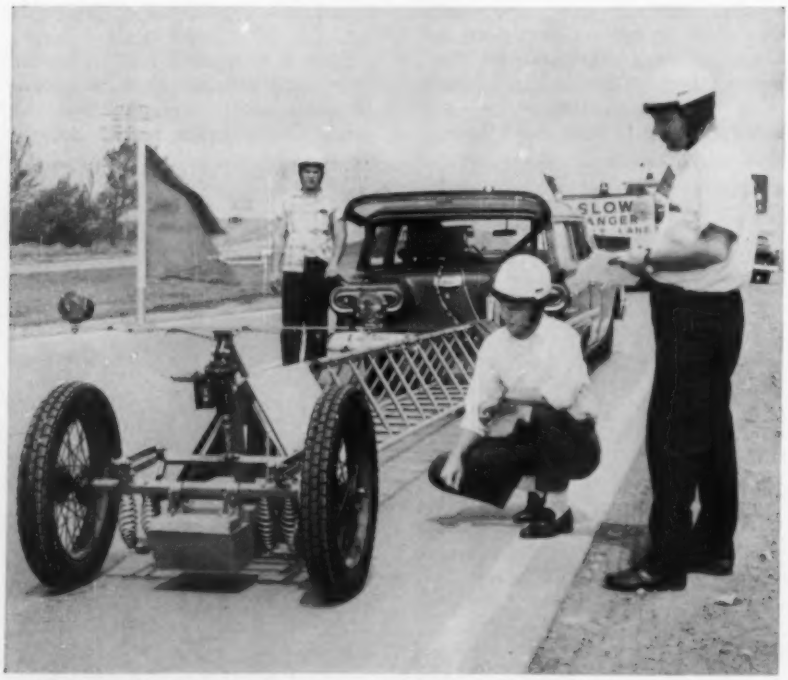
Fatigue Factor

The concentration of truck traffic on the Interstate system makes it desirable also to consider the matter of fatigue on structures. Now, the equivalent of two or three million heavy truck load applications on a structure may be obtained in many instances within the period of obsolescence of the bridge involved, whereas, in the past this would have been quite unlikely to have occurred except on a few metropolitan routes. Today that is changed. Truck loads are much heavier than they were as an average during the last 40 years and, of course, the number in the traffic stream is much greater. Consequently, the fatigue factor may become important, particularly in cases of springy composite beam design with welded cut-off cover plates on the lower flange.

Upon developing the timetable for various heavy maintenance operations, it will then be a relatively simple matter to establish expenditure programs on an annual basis for such work, and, in the case of the Thruway, to develop a plan for savings and investments which will yield the necessary expenditures at the right time.

With such a program, it will be possible to look ahead and plan financial and maintenance operations in proper coordination with other necessary obligations. This is the type of planning which would have prevented the severe storm losses to George's home. It is the type of planning which will permit state and other highway organizations to save billions of dollars of unnecessary future expenditures, and assure the multitude of private investors dependent on the Interstate systems that the highway transportation they depend upon will be continued at maximum efficiency. It is the type of planning which will enable maintenance men to plan their operations, the purchase and retirement of equipment, and the development of their organizations in a sound and orderly manner. It is the type of planning which will boost and hold the morale of the highway maintenance people. And last of all, but not last in importance, it is sound fiscal management of public funds. □□□

● **VISUAL survey team at work. Driver calls off tenths of miles. Men standing in rear are responsible for observing and recording cracks, transverse and longitudinal joint conditions and spalling, faulting, shoulder conditions and other needs.**



● **PROFILOMETER shown with its towing vehicle which carries the computing and recording instruments. Three-man crew takes readings and prepares records of work.**

Maintenance Expenditures Reported

According to the 1960 Annual Report, the New York Thruway spent over $5,763,000 last year on its maintenance program. This expenditure represented about 15 percent of the total dollar income for the year. In addition to the major winter snow and ice control program, special pavement repairs were made in several areas.

Don't Abandon That Old Incinerator ...Yet

● REBUILT incinerator at New Canaan, showing control room and new 2½-ton monorail crane. Charging floor was raised to level of window sills to provide clearance for furnace on lower floor.

GLEN H. ABPLANALP
Partner,
and
JUNIUS W. STEPHENSON
Project Engineer,
Havens and Emerson,
Consulting Engineers,
New York, N.Y.

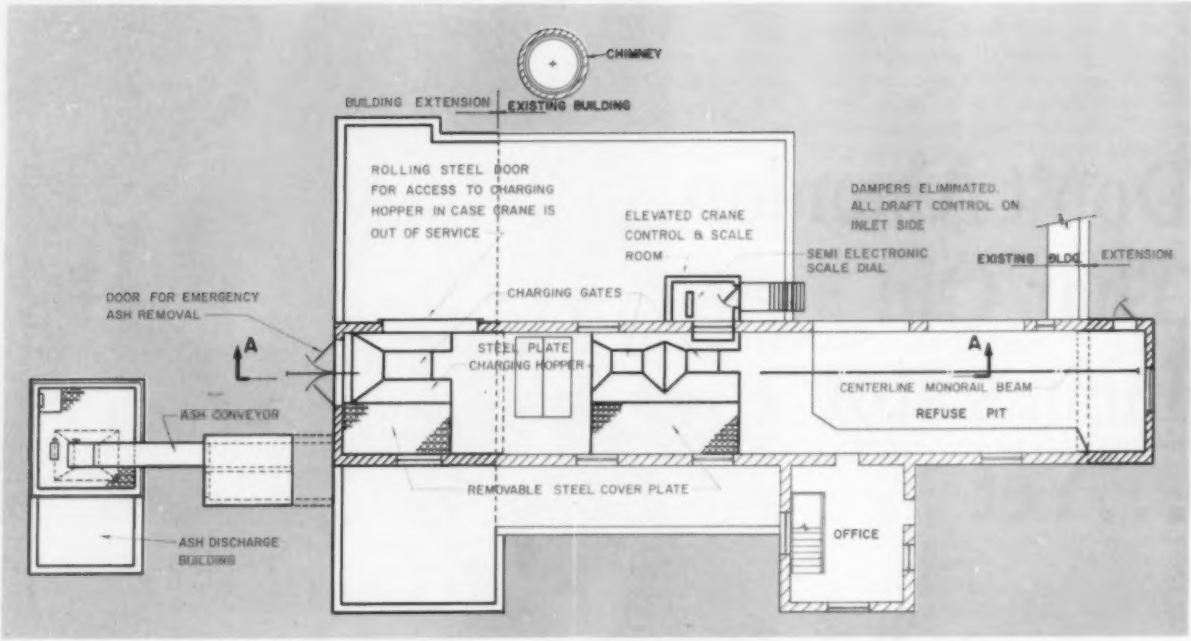
WITH the great change that has taken place in the composition of refuse in recent years, many municipal incinerator plants are no longer capable of burning refuse satisfactorily at their original design rates. Some are, at best, so under capacity or so outmoded as to be of little or no value to serve the needs of growing communities and the increasing quantities of modern refuse; many others can, however, be modified or reconstructed to meet the present need, usually at a cost substantially lower than that of a complete new plant. This is why we say, "Don't Abandon Your Old Incinerator—Yet," or at least not until a thorough study has been made to determine whether it can be modernized economically.

As recently as twenty years ago, normal municipal refuse contained 50 percent or more garbage and was wet, heavy, and compact. Incinerators were designed accordingly, with special hearths or other provisions for drying the refuse before it was pulled down onto the burning grates. Preheaters, auxiliary burners, and other devices were provided in the constant struggle to maintain the temperatures required for satisfactory, odor-free combustion. Furnaces, chambers, and flues were sized for the relatively low unit volumes of refuse, combustion air and products of combustion.

Present day refuse is light and bulky, frequently containing 85 to 90 percent or more combustible rubbish, and 10 to 15 percent or less of gases of combustion and comheaters are no longer required; the problem is one of holding temperatures down rather than up. For satisfactory operation, today's incinerator plant must be capable of handling a greater volume per ton of refuse as received and as charged to the furnaces; higher combustion temperatures; and greater volumes of gases of combustion and combustion air.

Depending on age, type of equipment, and original design, some plants built even as recently as the immediate postwar years are proving inadequate, with the cause usually traceable to one or more of these factors. In some plants, limited floor storage area or pit capacity may be inadequate for today's bulky refuse. Where a portion of the furnace floor is occupied by a drying hearth, the limited area of burning grate may be inadequate. It may be physically impossible to burn modern refuse at design capacity uhder the conditions of manual stoking required in practically all pre-war plants and some post-war installations. Charging openings and furnaces themselves may be too small to handle the volume of bulky refuse. Relatively small mixing, combustion and subsidence chambers may result in incomplete combustion and discharge of "blackbirds" or excessive quantities of fly ash from stacks. Flues, chimneys, and other gas passages may be small, restricting the flow of the greater volumes of combustion air and gases of combustion from today's highly combustible refuse.

The simplest solution to the problem may be one of plant operation, since today's refuse requires somewhat different operating procedures from those of the past. While exact procedures for optimum results vary from plant to plant, there are a few points that generally hold true. Foremost is the fact that today's average municipal refuse does not have to be dried on hearths or elsewhere before burning. For most efficient operation, it should be charged as nearly as possible in position for burning. A uniform depth of firebed is a necessity, usually ranging from two to four feet depending on type and size of furnace. In most plants it has been found that the old "fill and draw" method of operation, in which furnaces are completely cleaned before fresh refuse is charged, does not produce the best results. The extreme case, in which the furnace is packed full of refuse, or nearly so, then allowed to burn down, is seldom if ever satisfactory. The trend today is toward dumping only that portion of the firebed which is most completely burned, and charging fresh refuse in smaller quantities at more frequent intervals. This not only maintains more constant burning, usually at a higher rate, but also tends to maintain more uniform



● **HEAVY lines and labels in color show new structures and equipment at the rebuilt Darien, Connecticut, incinerator.**

temperatures which help to prolong refractory life.

Unquestionably, the most frequent modification of incinerators in recent years has been the replacement of fixed manually stoked grates with modern mechanical grates. Such mechanical grates are sometimes referred to as "automatic", although this is misnomer as some manual stoking is required; however it has been demonstrated that, with very few exceptions, installation of mechanical grates will permit a substantial reduction in manual stoking and will at the same time result in an increase in burning capacity. An outstanding example is the plant at Stamford, Conn., where average daily burning capacity was reported to have been increased from 210 to 290 tons per day, or approximately 40 percent after installation of so-called "rocking" grates. An increase of some 25 to 30 percent in daily capacity was reported for the 150-ton plant at Greenwich, Conn., after a similar installation. During the past ten years, mechanical grates have replaced older manually stoked grates in some thirty or more plants ranging as high as 900 tons per day design capacity. With few exceptions, improved burning conditions have resulted, with the increase in capacity usually between 10 and 25 percent.

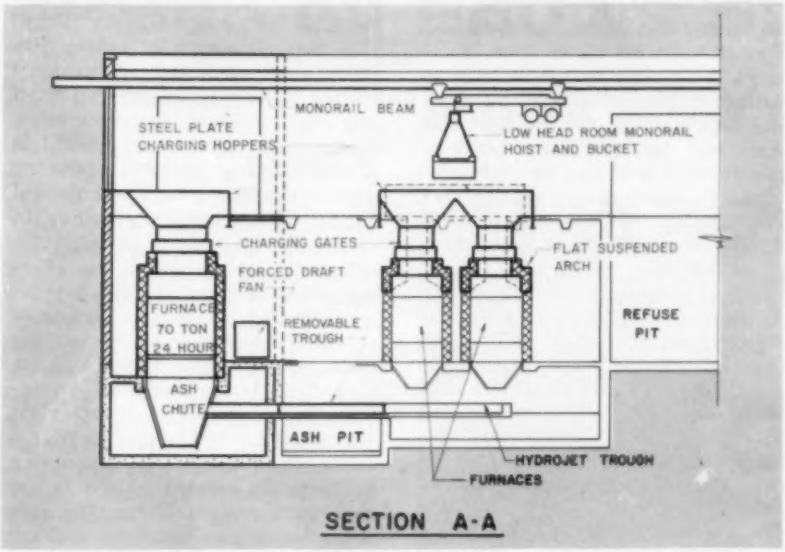
A problem facing many incinerator plants today, especially in older floor dump plants, is that of refuse storage. While the available space may have been sufficient to store the heavier, more compact refuse of the past it is frequently insufficient to hold more than a small part of today's light, bulky material. It is not uncommon, in older floor dump plants, to see either a long line of collection trucks waiting to dump, or refuse from early deliveries piled high outside the building, or both. In some instances, this has constituted such a nuisance and potential fire hazard that it has been necessary to abandon the plant and turn to other methods of refuse disposal.

Rescheduling of refuse collections has been tried in an effort to arrange delivery of refuse to the plant more nearly at the rate at which it can be burned. This has seldom been satisfactory, especially where collection crews are permitted to go home after completing their routes, or where collections are normally completed early in the day, while the incinerator operates a full shift or longer.

Provision of additional floor storage area is seldom the solution to the problem for various reasons, notably the excessive labor requirements for handling the refuse. A more satisfactory solution is construction of a refuse storage pit of adequate size, usually with a crane and bucket to transfer refuse from the pit to charging hoppers. This arrangement is most economical where there is sufficient headroom in the existing building for operation of the crane and bucket with the necessary clearance between the top of the charging hopper and the bucket in its high position. This should be 3 feet if possible, but not less than 2 to 2½ feet. If the roof must be raised to provide sufficient headroom, the cost of this work becomes a factor.

In smaller plants especially, it may be possible to utilize a monorail crane instead of a more expensive bridge crane if plant layout is such that the refuse pit can be constructed in line with charging openings. In this case, the pit must be designed carefully to permit complete cleaning with the bucket.

A novel but very effective solution to this problem was reached at the Waltham, Mass. incinerator.[1] Two refuse storage pits were constructed inside the incinerator building, arranged to receive refuse directly from collection trucks. The problem of transferring refuse from pits to charging hoppers within the 13-foot headroom available was solved by adapting a hydraulic backhoe on crawlers for refuse handling. The backhoe was equipped with a standard pulpwood grapple and rotator, and a modified telescoping stick. This arrangement has been eminently satisfactory. Among the advantages reported are elimination of the necessity for trucks to wait in line to dump, reduction of the working force on the charging floor from four men to two under



● **MODERNIZATION program increased the rated capacity of the Darien incinerator from 60 tons per day to 130 tons per day at less than half the cost of a new plant.**

safer working conditions, and ability of the plant to handle a greater variety of materials because of the mixing now possible.

Mention should be made, in passing, of the use of conveyors for refuse handling. This is frequently suggested and has been tried in incinerators; however, to the authors' knowledge, conveyors have never proven completely successful in this application.

Examples of Modernization

To illustrate the varying extent of alterations or reconstruction required to modernize different plants, the following three plants with which the authors are familiar are presented as examples.

Mount Kisco, New York: This three-story floor dump type plant was built in 1948. It includes a manually stoked two-cell rectangular furnace, mixing chamber, combustion chamber, flue and chimney. Design capacity was 40 tons in 24 hours, or 13.33 tons in an eight-hour operating day. The furnace floor was approximately one-third solid refractory hearth and two-thirds burning and dumping grates; burning rate on these grates at design capacity would be more than 70 pounds/square foot/hour. Operation was further complicated by the fact that the old pivoted type ash gates were inoperative and had to be left open at all times. Ashes could not be quenched properly, and the forced draft fan could not be used because the air escaped through the open gates, creating a prohibitive dust problem. Furnace temperatures were estimated to rise as high as 2300-2400°F. Complete refractory replacement was required every three years.

Refuse collections in 1960 in Mt. Kisco averaged slightly over 12 tons per day, 4 days a week, for a total of 48 to 50 tons per week. Of this, the plant was able to burn an average of only about 8.5 tons during eight hours on each of the four collection days. The remainder was trucked to a county dump, a round trip of about 36 miles. Obviously, operation at or near design capacity would be desirable.

From a study of the plant and its operation, certain modifications were indicated which, it was believed, would effect a substantial increase in actual burning capacity. Work under way at this time includes: 1) Replacement of refractory hearth with burning grates. Grate area will be increased about 50 percent, and burning rate at design capacity will be reduced to under 50 pounds/square foot/hour. Mechanical grates were not recommended for this installation because it was not felt that they would be effective in a furnace only 75 ins. deep. 2) Two overfire air doors are being installed in the furnace for temperature control. 3) The temperature recorder installation is being reconditioned, with the thermocouple relocated for better access. 4) New ash hoppers with water sealed rack and pinion operated ash gates are being installed. 5) The concrete charging floor, which was worn down to expose the reinforcing steel at several points, is being resurfaced with cast iron grids embedded in concrete for better wear resistance. Changes in gas passages were deferred; however, when refractory work is required, passages between chambers will be enlarged to permit freer flow of gases.

With the above modifications and with adoption of improved operating techniques, it is expected that this plant will be able to handle the average refuse production of the Village satisfactorily, although somewhat longer daily and/or weekly operating periods may be necessary during periods of heavy production and to meet the needs of the future. Total construction cost of the above work, exclusive of charging floor resurfacing and future refractory work, will be under $9500.

Darien, Connecticut: This bin-and-crane type plant was built in 1941, with total design capacity of 60 tons per 24 hours in two 30-ton furnaces. The original fixed manually stoked grates were replaced with mechanical grates in 1956, but actual capacity has still averaged only 80 to 85 percent of the design rate.

A study of Darien's needs for the future showed that a plant having a capacity of 130 tons in 24 hours would be adequate for the next 20 to 25 years. The study also showed that such a plant, operated one shift per day, would be more practical and economical than two or three-shift operation of the present plant at design capacity.

Inspection of the present installation and observation of its operation indicated four factors as primarily responsible for the under-capacity operation: 1) Small charging openings located over the center of the furnace. Refuse must be pushed through them by hand, then manually spread over the grates; both operations are wasteful of manpower and time. 2) Volumes of furnaces and chambers are low by modern design standards. 3) Gas passages and flues are small, restricting the flow of gases. This is undoubtedly the cause of the consistently noted unequal burning rates and temperatures in the two furnaces. 4) Ash removal is time consuming and requires the attention of all plant personnel. Ashes from the two furnaces are sluiced to a sump from which they are removed by the same low-speed monorail hoist and single-line clamshell bucket as is used for charging.

In order to provide the required 130-ton capacity, construction is scheduled for this fall on a new 70-

ton furnace and modifications to the existing furnaces. The new unit will include rocking grates to maintain uniformity of equipment, a combustion chamber, a spray chamber, and flue connection to the existing chimney. Ashes will discharge to a water filled drag conveyor trough.

Work on the old furnaces to bring them up to design capacity will be as follows: New, larger charging openings nearer the rear of the furnaces to permit refuse to be deposited in the most desirable position on the grates with a minimum of manual pushing and spreading; replacement of existing sprung arch roofs in furnaces and combustion chambers with raised flat suspended arches, to increase the volume of these chambers; and enlargement of flues and gas passages to reduce draft losses and improve gas flow conditions. The existing ash sluice will discharge to the new conveyor trough, with the present sump retained for emergency use only.

Other work will include structural reinforcement and enlargement of the incinerator building, and a new small heated building to house the discharge end of the ash conveyor with a small storage hopper and gate. The two existing low-speed monorail cranes and single line buckets will be replaced by a single higher speed unit with a two-line clamshell bucket. Through the cooperation of the crane manufacturer, a special low headroom crane has been designed to provide the necessary clearances in the headroom available. Crane controls and a new electronic-type truck scale dial with printer and recorder will be centralized in an elevated control room located to permit the operator to observe trucks weighing and dumping and to afford full vision of the refuse pit and the three charging hoppers. The existing truck scale will be reconditioned. A load cell will be installed in the scale pit, replacing the existing extension levers and permitting the dial and printer to be remotely located.

The present refuse pit will be adequate for the enlarged plant. The present chimney will also remain; however, it is expected that either enlargement of this chimney or construction of a new chimney will be necessary when full 130-ton burning capacity is required.

Total construction cost without chimney work is estimated at approximately $275,000. With a new chimney, the cost would still be roughly one-half that of a new plant of comparable capacity.

New Canaan, Connecticut: This old three-story floor dump plant had a rated capacity of 40 tons in 24 hours in a single basket grate type furnace with combustion chamber, preheater and damper. By 1953, the plant had become almost useless. The furnace was unable to handle refuse at anything approaching design capacity, and the refuse it did receive was very poorly burned. Floor storage area was limited, and a large proportion of the town's refuse was placed directly on the adjacent dump.

To meet New Canaan's needs, it was determined that, for single shift daily operation, a 50-ton per 24-hour plant would suffice until the early 1960's, and that by 1975 or 1980 a 100-ton plant would be required.

Aside from the building itself, the old installation was found to be completely inadequate for continued use. Consequently, the entire installation except the building shell was removed, including charging and operating floors, pitched roof and chimney. A new 50-ton circular furnace was installed in the building, with the new mixing, combustion and expansion chambers and chimney outside. A long, narrow pit was provided for refuse storage, together with a monorail crane and 1½-cubic yard two-line clamshell bucket for refuse handling. New charging and operating floors were provided, raised above the original floor levels as required to accommodate the new equipment. Building walls were raised approximately 13 feet, and topped with a flat roof. Combustion and expansion chambers, chimney, refuse pit and monorail crane were sized for the future 100-ton capacity. Inside the building, a small office was provided on the charging floor with a control room directly above it. This control room houses crane controls and scale dial and printer and gives the operator unobstructed vision of the refuse pit, charging hopper, and 20-ton capacity truck scale. A private washroom for plant personnel and a public toilet are also provided on the charging floor. Construction was completed in 1956 at a cost of approximately $218,500. This may not appear to represent a great saving over the cost of an entirely new 50-ton plant until it is realized that many features are provided for future expansion. Essentially, the only construction required for 100-ton plant capacity will be a new furnace and connecting flue, and the necessary building extension. Furthermore, an ideal sidehill location was retained, complete with access roads.

In any discussion of refuse disposal the possibility of sanitary landfill should be considered as a less costly alternate to incineration. Unquestionably, sanitary landfill is cheaper where suitable dumping area is available within economical hauling distance of the source of refuse. In long range planning for refuse disposal, however, one glaring error must be avoided: A community must not plan to dispose of refuse by sanitary landfill to the limit of available dumping area, then turn to incineration. An efficiently operated incinerator plant will still turn out burned residue—ashes, cans, glass, etc., amounting to 15 to 25 percent of the refuse charged; therefore, if dumping area is limited, a plan involving sanitary landfill followed by incineration must contemplate termination of the landfill operation while there is still sufficient area available for disposal of incinerator residue during the life of the incinerator.

To sum up, an old incinerator plant that is causing trouble need not be abandoned just because it is old. It may have hidden assets which will permit its conversion to a modern, efficient plant at surprisingly low cost. □□□

Reference

(1) "Backhoe Solves Incinerator Problem", PUBLIC WORKS, March, 1961.

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Conference on Solid Wastes Disposal Scheduled by University of Pittsburgh

Latest methods for solving problems associated with municipal solid wastes disposal will be presented and discussed at the Third Pittsburgh Sanitary Engineering Conference. The conference, to be held November 4 at the U. of Pittsburgh's Graduate School of Public Health is designed to interest sanitary engineers, municipal officials, incinerator or landfill operators, sanitarians and equipment manufacturers.

Joint sponsors with the U. of Pittsburgh Graduate School of Public Health are: ASCE, Carnegie Tech's Civil Engineering Department, Associated Wastes Engineers of Pittsburgh and Pennsylvania Department of Health.

Persons wishing to attend may preregister by sending $5 for registration and luncheon to: Dr. Eugene Weisberg, Chairman, 1626 Forbes Avenue, Pittsburgh 19, Pa.

Survey Shows State-Owned Highway Equipment

HIGHWAY MAINTENANCE burdens have shown a steady increase in most states during recent years. To meet this increase, state officials are faced with the need for more realistic budgeting of maintenance funds and more effective equipping of maintenance crews with modern, efficient machines capable of doing the maximum job at the minimum cost.

The editors of PUBLIC WORKS have completed a survey of major maintenance and construction equipment owned by the various state highway departments in 1960. Table I shows a breakdown of trucks, passenger vehicles and ten categories of equipment as reported by the 30 states responding.

Courtesy Highway Information Services

● **THESE Ohio Turnpike trucks typify the modern, versatile equipment needed today.**

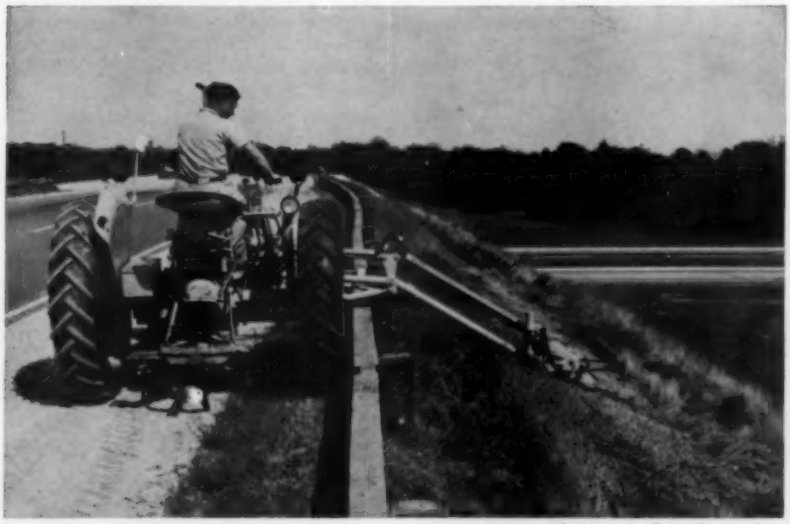
Interstate Plans

In addition to a request for ownership information, the States were asked about plans for Interstate system maintenance. Several interesting programs were reported.

Connecticut. With the exception of the Connecticut Turnpike (I-95), only a small portion of the Interstate system is completed. The maintenance plans are a modified version of those followed by the Connecticut Turnpike. Typical section lengths will be 8 to 10 centerline miles. Representative section equipment would include four 6-8 ton dump trucks, four truck-body automatic jet sanders, six snow plows, one 1 cu. yd. front end loader, one tractor mower with sickle bar and four to six rotary mowers. Additional equipment to serve for several sections would include power pick-up sweepers, eductors and compressors. Some rented equipment is to be used for winter storms when required. Section personnel would include a crew leader and 9 to 14 workmen.

Georgia. In addition to establishing Interstate maintenance sections of about 25 centerline miles in length, plans also call for a "floating" section to work where required along each 75 to 100-mile segment. Within a one-half mile radius of a centrally located interchange in each section, a 30-ft. by 90-ft. maintenance building will be placed on a minimum 2-acre site. Section equipment will include two 4-cu. yd. dump trucks, ½-ton pickup truck (radio equipped), three 45-hp rotary tractor mowers, two sickle bar tractor mowers, motor patrol with 12-ft. blade, a 600-gal. asphalt kettle (4-wheel mounted) and a wheel tractor with ½-cu. yd. front-end loader attachment. The "floating" section will have a crawler mounted front end loader, a wheel-mounted, two-bag concrete mixer, a Gradall with various attachments, a Jetcrete machine, a 175-cfm air compressor, portable electric welder, a 3-in. pressure pump, three 4-cu. yd. dump trucks, heavy-duty wrecker truck and a transfer truck and semi-trailer.

Indiana. Early planning called for Interstate maintenance sections of from 25 to 35 centerline miles in length, 60-ft. by 150-ft. maintenance garages with asphalt storage



Courtesy A. C. Anderson, Inc.

● **MECHANIZATION can eliminate costly hand mowing and increase productivity.**

● **RADIO-equipped trucks provide a fast, efficient maintenance operation.**

tanks and storage yards. Typical section equipment would include a motor grader, 4 trucks, 2 pickups, a wrecker, station wagon, patching roller, 750-gal. distributor, tar kettle, tractor backhoe, 2 front end loaders and 22 mowers.

Illinois. Average Interstate maintenance section length will be 12 centerline miles, with some variation dependent upon interchange frequency and size. Section equipment will include: Two 2½-ton dump trucks equipped with snow plows and tailgate spinner spreaders; one 6-ton, 4-wheel-drive or tandem axle truck equipped with snow plows and hopper-body spreader; and two tractor mowers. Additional equipment to serve for every 3 sections will include one 1-cu. yd. wheel-type end loader, a pavement sweeper and one 2½-ton stake-body landscaping truck. A 75-hp motor grader will be assigned for every 9 sections. Plans for crew organization call for each section to be staffed by five men, possibly under the authority of a foreman or supervisor responsible for several sections.

Nebraska. Tentative plans call for Interstate maintenance section lengths of 20 to 50 centerline miles, dependent upon topography, soil conditions, traffic volumes and surface types. Section equipment will include trucks, loaders, mowers (predominantly rotary type), motor graders, spreaders, reversible straight plows, V-plows and possibly a rotary plow for each 3 or 4 sections. Sections will have a building, storage yard and fuel storage tanks. Section crews will consist of a foreman and required laborers with a superintendent in charge of 3 or 4 sections. Foremen and superintendents' pickup trucks will be radio-equipped.

Oklahoma. Carefully developed preliminary plans call for dividing the Interstate mileage (approximately 637 miles when completed) into 12 maintenance sections, averaging 53 centerline miles and 17 interchanges each. The section will have a headquarters building with storage area located near the center of the section. Each section will be equipped with a 600-gal. distributor, tar pot, booster heater, chip spreader, 3 chemical spreaders, weed sprayer, rotary power broom, Heat-A-Mix, 2 motor patrols, 10 mower tractors, a pneumatic roller, a vibrating roller, a 5/8-cu. yd. truck-mounted crane, two ¾-cu. yd. tractor loaders, a 40-hp wheel tractor, a D-6 crawler tractor with bulldozer, three ½-ton pickup trucks, six 2-ton dump trucks, a 2-ton wrecker and service truck and an equipment trailer. Section crews will consist of a foreman, 27 regular employees and 6 temporary or part-time men for seasonal programs. Radio communication is planned within the section.

Ohio. Length of a typical maintenance section is planned at 20 centerline miles with a centrally located headquarters garage and storage yard. Section equipment will include three 4-ton and two 2-ton trucks, a 1¼-cu. yd. front end loader, three mowers, five snow plows, five salt spreaders, a power broom, an 8,000-gal. gasoline storage tank, one ½-ton pickup truck and six radios. A set of tile cleaners and an air compressor will be provided for each pair of sections. Typical crew complement will be: Foreman, rest area caretaker and 12 other workmen.

Oregon. Specific Interstate plans have not been developed but a typical section, responsible for 62 miles including 19 miles of Interstate highway, is cited as having four light trucks, a Scoopmobile, an asphalt kettle, one rotary and one sickle bar tractor mower, a weed sprayer, three snow plows and two tailgate sanders. The section is staffed by a six-man crew. □ □ □

Courtesy Indiana Toll Road

● **SNOW and ice control equipment is a major category in most northern states.**

Courtesy M-B Corporation

● **THE increasing use of edge lines has placed an additional demand on stripers.**

Table 1—State Highway Department Equipment Survey
State Owned Equipment, 1960

State	Trucks, Total	Automobiles, Carryalls, Wagons	Self-Propelled Motor Graders & Maintainers	Self-Propelled Bituminous Distributors	Loaders, All Types	Tractors, Mowers and Misc.	Compressors, Air	Cranes, Draglines and Shovels, Power	Snow Plows, Push and Rotary	Electric Welders, Arc	Self-Propelled Rollers, 3 Ton & Over	Spreaders, Aggregate
Arizona	604	680	78	11	98	28	88	1	144	16	9	84
California	2885	2167	279	—	181	111	64	17	499	—	—	—
Connecticut	917	454	26	11	97	82	28	2	1202	16	23	805
Georgia	1774	—	217	25	152	314	41	32	—	13	68	—
Illinois	1574	312	94	5	133	768	116	11	2177	21	66	11
Indiana	1690	807	97	29	294	456	136	29	698	35	34	48
Iowa	1345	912	167	3	119	586	85	25	1640	6	27	289
Kentucky	2175	406	361	162	372	453	73	59	18	23	168	307
Maine	180	274	50	62	8	21	9	55	427	21	9	—
Maryland	644	387	85	1	82	225	48	15	4(b)	22	111	24
Massachusetts	861	429	23	—	44	44	63	1	—	—	17	—
Minnesota	1140	778(a)	125	16	270	253	10	15	1483	20	39	512
Mississippi	1050	20	180	34	34	289	73	41	—	23	22	100
Montana	622	273	123	35	94	80	4	12	496	20	23	12
Nebraska	916	—	—	—	—	—	—	—	—	—	—	—
Nevada	497	152	81	6	94	33	7	17	282	4	49	7
New Mexico	400	451	180	19	132	62	22	22	140	27	76	148
New York	2112	465	247	17	266	607	207	121	442	43	317	103
North Carolina	4404	940	755	49	559	362	131	109	1880	35	211	1
North Dakota	507	—	—	—	—	—	—	—	—	—	—	—
Ohio	2467	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	1095	130	197	58	33	342	36	20	74	12	49	109
Oregon	1047	945	99	—	200	45	51	37	540	3	63	—
South Carolina	2252	940(a)	355	19	143	144	51	77	2	26	138	192
South Dakota	521	221	152	40	130	252	12	9	422	11	46	180
Texas	4609	1031	651	49	476	1064	154	75	342	130	389	47
Virginia	2184	—	400	32	167	743	—	19	1814	—	238	55
Washington	806	834	73	34	98	87	33	24	540	25	35	55
West Virginia	1457	473	348	39	135	279	108	48	558	42	133	497
Wyoming	463	226(a)	75	23	56	67	5	7	311	5	14	40
Totals	**43198**	**14707**	**5518**	**779**	**4467**	**7797**	**1655**	**900**	**16135**	**599**	**2374**	**3626**
Responses	**30**	**25**	**27**	**24**	**27**	**27**	**26**	**27**	**24**	**24**	**26**	**22**

(a) Includes Highway Patrol Vehicles. (b) Only rotaries reported.

County Tackles 21,000-Acre Reservoir Clearing Job

BEN F. HICKEY
General Manager,
Tarrant County Water Control and
Improvement District No. 1,
Fort Worth, Texas

AT A RESERVOIR site in Texas, tractors are bulling their way through dense hardwood forest including pecan trees up to 72 inches thick. A Rome K-G clearing blade, mounted on front of Caterpillar D8H power shift tractors, was used to split the heart of a tree, weakening it so that it is felled by a nudge from the tractor. The cutting edge is then employed to shear it at ground level. Not all the trees are this large; they average 10 inches in diameter. These are severed in a single pass.

Using its own forces, the Tarrant County water district is clearing some 21,000 acres of a 38,000-acre site for Cedar Creek reservoir, one of the future sources of Ft. Worth's water supply. Six new Cat D8H and two D6B crawler tractors are doing the job at a total cost (including overhead and supervision) of $24 an acre. This is based on 50 percent amortization of equipment after 4,200 hours use (17 months), the estimated time required to complete the job. At 100 percent amortization, the cost is estimated at $30 per acre.

A factor in the district's decision to use its own personnel and equipment was timing. Since not all of the land has been acquired, it would be necessary under a contract basis to call for bids as each tract was obtained, or else delay clearing until most of the acreage had been purchased.

Offsetting these advantages somewhat was our lack of experience in clearing. However, we believed this could be (and was) overcome with preparation and training. This would not be true of earthmoving, a considerably more complex operation. For this reason, construction of the dam and spillway will be turned over to earthmoving specialists on a contract basis.

The reservoir site is located in Kaufman and Henderson counties. Fed by Caney, Clear, Twin and Cedar Creeks, the reservoir will be 18 miles long, a maximum of eight miles wide, and an average of 35 feet deep. When the total project is completed in 1965, Cedar Lake will impound 679,000 acre-feet of water which can be piped into the Ft. Worth area (Tarrant County) some 85 miles away. By the year 2000 when the Tarrant County current population of 600,000 will have increased to an anticipated 1.7 million, its water requirements will have climbed to an estimated 430 mgd from the present 91 mgd.

Its citizens decided to do something about it now. They approved a $55 million bond issue for the development of Cedar Creek reservoir, which will nearly double its water supply. Two other reservoir projects being planned will add an additional 217 mgd. In February, 1960, $6 million in bonds were sold to finance part of phase one of the project, which includes land acquisition, clearing, adjustment of conflicts (railways, highways, etc.) and the start of construction on a dam and spillway. The second phase will include construction of a pipeline and initial pumping stations, and the third phase, construction of a terminal storage reservoir, additional pumping stations and land for future dams.

Planning the Operation

Before tackling a job of this scope, Eugene Fruhwirth, General Superintendent, visited several large clearing projects in the Southwest. Aerial photos were taken of the site. At ground level the land was surveyed by electronic Tellurometer. Contour maps were drawn and

● **STINGER is jabbed into tree trunk to simplify job of felling. Trees are cut off at ground level by knife-sharp blade leaving roots and base of trunk in ground.**

studied. Divided into 67 sectors the wooded portion was found to average 350 trees per acre. Species included oak, elm, black walnut, cottonwood, cypress, hickory and pecan—the last two being the toughest.

We considered several types of machines and decided that the Caterpillar power shift D8 model would meet our requirements. In a test on an average 10-acre plot at the site, using the D8 and Rome K-G blade with a professional operator, the area was cleared in two hours and 20 minutes, or 4.3 acres per hour. For the next few months after the equipment was purchased we experimented with various methods of felling, stacking and burning. In each case we conducted time and cost studies.

The Board concluded that the most efficient spread would consist of two D6s and six D8s, the latter equipped with K-G blades. To give additional protection to the operators and tractors in the heavy timber, Superintendent Fruhwirth fabricated cabs of 4½-inch drill stem, with heavy-duty overhead screens to protect the intake and exhaust stacks, added side screens to prevent leaves from choking the radiator and a rear rack to guard the cable control. To shield the radiator guard, he welded ½-inch plate steel to the center portals of the blade. On the D6s he moved the intake stack to the rear of the cab to avoid flying ash.

Clearing began in earnest in January. The crew now clears 1500 to 1800 acres per month. Each unit is cutting an average of 1.5 acres per hour and stacking 1.75 to two acres an hour.

Clearing Technique

The following clearing technique is used: Sites are laid out in a rectangle. The lead tractor marks the perimeter. The other D8s follow at 50 to 100-foot intervals and on a diagonal, a blade width apart. Because of the angle of the K-G blade, the machines work in a counterclockwise direction. There are several advantages to the "straight-line" method: Twisting and turning is kept to a minimum and all the machines can be observed from one location by the clearing superintendent.

Maintaining adequate spacing between tractors gives the individual operator enough latitude should he encounter sparse growth. He can thus take advantage of the power shift transmission, shift to third gear and hurry to the next grove. Most of the cutting is done in second, some in third gear.

When the sector has been completely cut, the tractors return to various points along the perimeter and doze the timber toward the center. The trees are stacked in piles. The tractors then move over to a contiguous tract. Meanwhile a Ford tractor carrying a barrel of diesel fuel and pump sprays the piles, and the D6s "punch" the burning stacks, each tractor usually handling three piles.

The tractors are accompanied from sector to sector by the service and fuel-lube trucks. In this way time is not lost in backtracking to a stationary service area. As the tractors penetrate into the heart of the forest, a service road is built, enabling operators to reach the work site in the morning. Each operator carries a first aid kit, snake bite kit and a bee's net.

Servicing is done at night with light from a portable 10KW generator plant. Cutting edges of the blades are usually sharpened at this time with a portable grinder.

When the clearing job is finished the tractors will prepare a 78-mile, 100-foot right-of-way for the 72-inch reinforced concrete pipeline. In addition the tractors will be used to clear and prepare a 500-acre site for the terminal storage reservoir with a capacity of 500 million gallons.

The earthfill dam at Cedar Creek reservoir, which will be let for contract, will cost an estimated $4.3 million and will require some 4.4 million yards of material. It will be approximately 7,000 feet long, 80 feet high and 1,100 feet wide at its base. An adjacent levee section will increase its overall length to 17,000 feet. About five miles northwest of the dam a $5.5 million spillway will be constructed with some preliminary work already contracted. A gated-chute type structure, it will have a net crest length of 600 feet with radial sector type gates 40 feet wide and 15 feet high. At maximum flood level the spillway will be designed to discharge at the rate of 284,000 cfs.

The reservoir site is bounded by the towns of Trinidad, Malakoff, Eustace, Maybank and Kemp. For these towns, as well as Ft. Worth, the birth of Cedar Lake in 1964, with its 304 miles of shore line, will mean boom years ahead with the attraction of industry to the area and by the commercial development of a resort area. □ □ □

● **SHARP blade is a necessity, so before day's work begins the cutting edge of the clearing blade is ground.**

● **PROTECTION was necessary for the tractor operators. Screens were provided to protect intake and exhaust stacks. Radiator was covered with a welded steel guard.**

Special Assessment by FORMULA

FRED D. DAHLMEYER
City Assessor
Hollywood, Florida

THROUGH the ages, taxation has been one of the most controversial subjects of discussion. Cities have used many different methods and combinations of methods in an attempt to solve the vexing problem of special assessment. Among those methods are the following: 1) The front foot value; 2) the area of the property benefited; 3) proximity of the land to the improvement (benefit zones); 4) a charge apportioned upon the land value; and 5) the actual cost of work done on or in front of each parcel.

The City of Hollywood was faced with the typical problems: The need for adequate revenues; taxation according to benefit and ability to pay; simplicity and workability of the formulated solution; and a justification for the system of taxation itself.

With experience, the formulae were molded into a working system and road construction assessments were reduced entirely to mathematical computations, thereby insuring complete objectivity.

Chapter 30 of the City of Hollywood Charter, Section 217, provides that: "Except where hereinafter stipulated, the cost of making highway improvements shall be assessed against all lots, and separate tracts and parcels of land in proportion to the special benefits derived by reason of the construction of the improvements and not in excess thereof. The area of the lot or tract of land and its location and distance from the improvement or way upon which the improvement is made shall be considered in making the assessment. Lots or parcels of land situated within half the distance from the street, highway, avenue or other public way, except alleys, upon which the improvement is constructed and the next street, highway, avenue or other public way shall be assessed for the improvement but in case that there be no street, highway, avenue or other public way within six hundred feet of the street, highway, avenue or other public way upon which the improvement is constructed then only that property within the first three hundred feet shall be assessed. When the highway improvement shall be constructed upon a regularly platted alley or a public way specified as an alley in the initial proceedings for the improvement, those lots and separated tracts and parcels of land lying within the block shall be assessed for the cost of improvement but in no case shall property situated more than one hundred seventy-five feet from the said alley be so assessed."

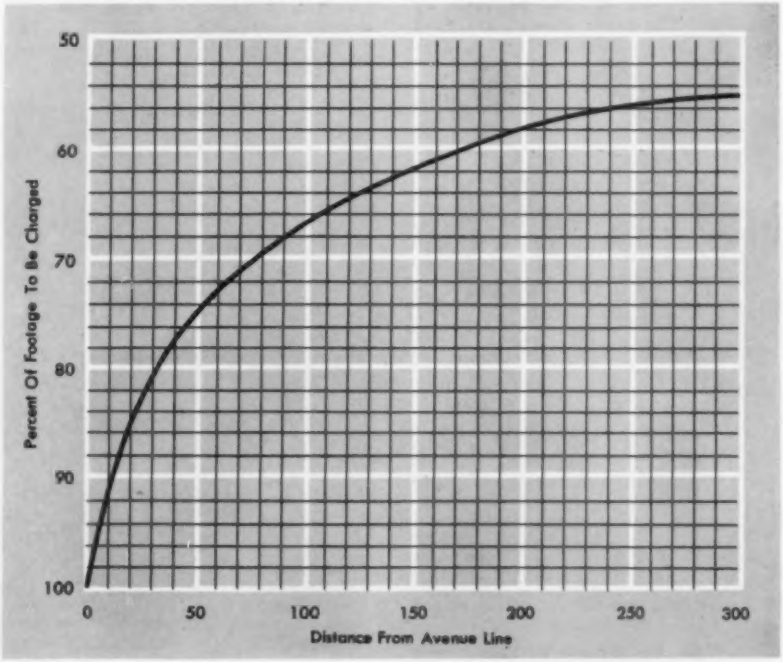
Cognizant of the fact that properties are not benefited directly proportional to their distance from an improvement, the City of Hollywood has used for more than two decades an elliptical curve to show the relationship between distance and benefits. The Assessment Curve is the northwest quadrant of an ellipse. The ellipse has a horizontal axis of 30 inches and a vertical axis of 22½ inches. With the curve starting at a point equal to zero feet and one hundred percent benefit, the horizontal is divided at one inch equals twenty feet and the vertical at one inch equals four percent so that the percent of benefit diminishes in relation to the curve as the distance increases from the improvement. The complete horizontal axis would therefore represent six hundred feet or a typical city block.

The following paragraphs show the method of apportionment of benefits under different property position to an improvement:

A. One half of the cost of an improvement shall be charged to benefit foot frontage and the other half to a benefit square foot area to equalize varied depth and shape of lots.

B. The square foot area shall be computed at the same percent of benefit as the front footage.

C-1. The benefit footage of a lot is usually computed from its platted front foot distance and when facing the improvement, its benefit is considered to be 100 percent of its frontage. An exception to this benefit is when a platted lot faces in an opposite direction from the majority of the lots in the block and has its long side running along the im-



● **ELLIPTICAL Special Assessment Curve is used by the City of Hollywood, Fla., to determine relationship between distance from improvement and benefit received.**

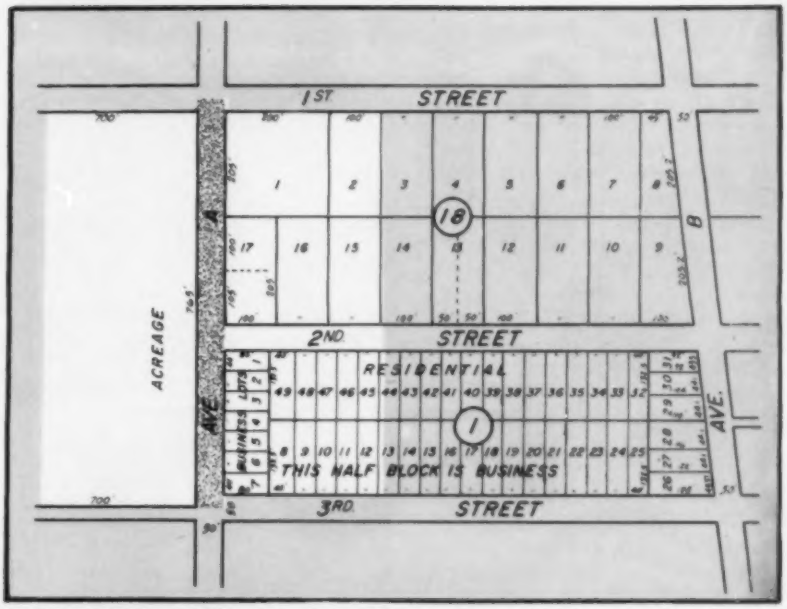
provement. Then that lot's benefit footage shall be its footage along the short side of the lot plus a figure determined by subtracting the short side from the long side and computing one third of the remainder.

Benefit footage for avenue improvement and for streets where lots face at right angle shall be computed at right angles to the improvement. However, corner lots facing, or lots which have been divided to face the improvement, shall be charged 100 percent of their new foot frontage. Otherwise, all lots facing a street running at right angles to the improvement should be assessed by their front footage corrected for benefit by the Hollywood Assessment Curve to a distance three hundred feet or one-half the distance to the next street, whichever is the shorter, from the improvement. The property line nearest the improvement is used to compute the distance from the improvement for the assessment curve.

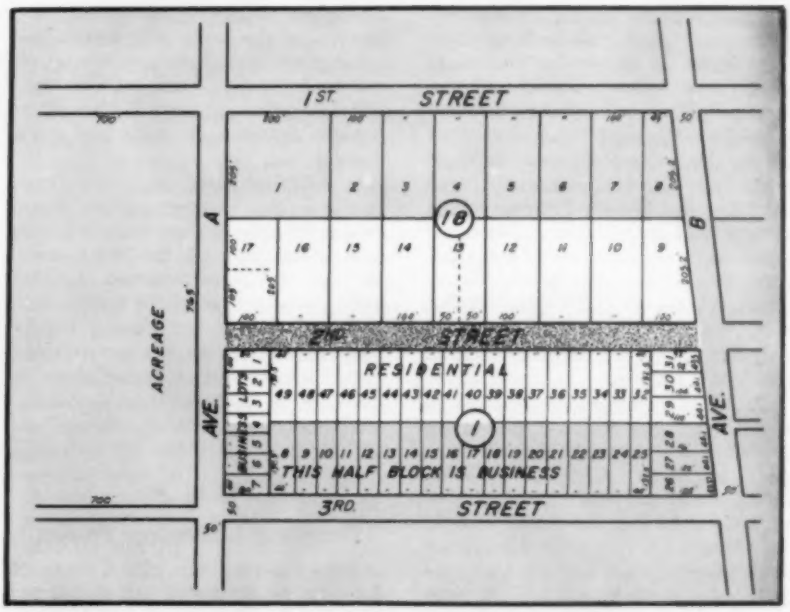
C-2. Lots not facing or abutting the improvements and not able to benefit directly by use of the improvement or a similar one, but lying within the assessable area as provided by charter shall be assessed for the benefit square foot area only, diminished by its distance from the improvement as shown by the City of Hollywood Assessment Curve.

C-3. There will occur unusually shaped or exceptionally large lots within the assessable area which do not fit into the usual pattern for assessment. Such properties may be divided for calculating purposes and benefits derived by using either the method used on a lot with its long side running along an improvement or the method of giving the first 100 feet its positional percent of benefit and discounting the balance at intervals of every fifty feet. This arbitration must be left with the assessor who in turn must make his choice of method so that the resulting benefits are equable with surrounding properties of similar accommodations, both present and potential. There are some lots, particularly in the Lake Section, where the platted blocks are one lot in thickness lying between two streets. These lots are to be assessed at their true front footage for one-half the cost of the improvement and one-half their square footage for the other half of the improvement cost.

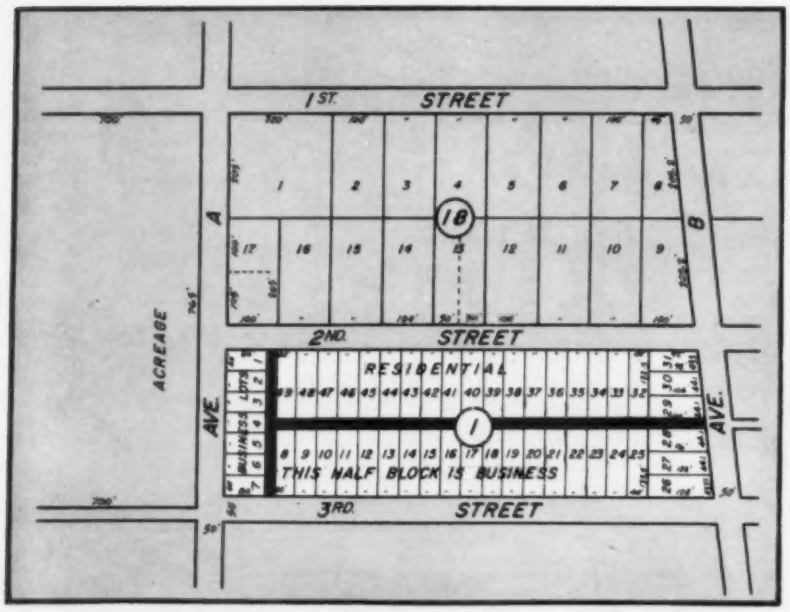
C-4. Acreage or tracts lying within the assessable area shall be calculated as follows: When abutting



In this example, covering a paving project on Avenue "A" from 1st Street to 3rd Street, properties within the white area would be assessed. Both front footage and areas of benefited properties are considered, with the total cost of the assessment being divided equally between these two factors. With the exception of the acreage west of Ave. "A", all properties facing the improvement are charged at 100% of benefit. However, Lot 16, Block 18, for example, which is 100 ft. from the improvement, is charged at 66.5% of the footage and area benefit, in accordance with the Special Assessment Curve on the facing page. Only 5 feet of Lots 13 and 44, Block 1, fall within 300 feet of the improvement, this portion being charged at 55% of benefit. The acreage is charged at 100% for the frontage and for the first 100 ft. of depth, and at progressively lesser percentages for each succeeding 50-ft. strip within the 300-ft. limit.



Assessments for pavement improvements on 2nd Street are charged against properties situated within one-half the distance from the improvement to the next street. Most of the lots involved face on the improvement and thus are charged at 100% of benefit. In Block 1, Lots 2 and 3, the north half of Lot 4, and Lots 29 and 30 are charged at lesser percentages of benefit depending on their distance from the improvement. The "Long Lot Method" described under paragraph C-1 in the accompanying text is used for computing benefit footage of Lots 1 and 31.



All properties in Block 1 are within the assessment district for improvements to the "Tee" alley within the block. However, benefits of residential lots are considered at one-half their computed values. Lots 26, 27, 30 and 31 are without direct benefit so the area square footage only and not the frontage is considered in computing their assessments; also the lesser percentage of benefit due to distance from the improvement applies to these lots. The "Long Lot Method" is used for computing frontage for Lots 8 and 49.

the improvement, the benefit footage shall be its foot frontage along the improvement. The area square foot benefit shall be computed at 100 percent for the first 100 feet depth and each succeeding fifty feet depth is given its positional assessment curve value. If the acreage or tract does not abut the improvement, the benefit foot values shall be computed at right angle to the improvement and changing the benefit footage values at fifty foot intervals for a distance of three hundred feet or one-half the distance to the next platted street, whichever is the smaller. The area square footage shall be computed at the same percent value as the front footage.

D. Alley improvement benefits in a normal block with lots abutting the alley are computed at 100 percent of their abutting distance. However, in the case of a lot platted or divided to face the street with its long way lying along the alley, then that alley distance shall be computed the same as a long lot mentioned in paragraph *C-1.* Lots that do not directly benefit from the alley but are within the improvement district shall be considered benefited by the area square footage only, computed as shown in paragraph *C-2.*

In the paving of alleys that divide business and residential lots, the business lot benefit front footage and area square footage shall be computed as stated above. But the benefits of the residential lots in the same project shall be considered at one-half their computed values. This is done to correct the alley benefits between business and residential lots.

It will be noted that the front footages, the area of the property, proximity to the improvement and the actual cost of the work performed are all considered. Special relief is also granted to corner lots and odd shaped lots. Every legitimate consideration is taken into account and weighted accordingly to produce a system that is easily understood, justifiable, more efficient and equitable. □□□

• • •

Financing a Sewerage Project

About a year ago, the Village of Le Roy, N. Y., voted 949 to 265 for $1.9 million bonds to construct a sewer system and treatment plant. Total cost was estimated at $2.15 million which amount would be reduced by a Public Health Service grant. A sewer rental charge was devised to pay off the bonds at the rate of $128,800 per year, including interest and principal reduction, and to provide $12,800 per year for operation. This charge was based on a unit system whereby for each unit a charge of $5.25 per month would be made.

Under this plan, a one-family dwelling is the basic single unit. The average store and individual business office are also considered single units. A three-family apartment represents three units: Where water in excess of 100,000 gallons per year is used, there will be an added charge. Factories are charged one unit for each 5 employees. Only sanitary wastes from factories and plants are treated; process wastes are handled in private plants. Public and parochial schools pay a one-unit fee for each 7 students and teachers.

Previously, residences in the village were served by septic tanks. Most of the owners using septic tanks were required to connect to the sewer system; but even if they do not, the unit charge of $5.25 will have to be paid.

Cincinnati's Muddy Creek Sewage Works

The Muddy Creek Sewage Works is the third and final primary sewage treatment plant of the Metropolitan Cincinnati Sewage Disposal System. The plant will serve a 26-square mile drainage area with a present population of approximately 45,000. The plant has been designed for primary treatment of sewage in accordance with Ohio River Sanitation Commission standards for an average flow of 7.2 mgd. Initially the average sewage flow is expected to be about 4.0 mgd.

Basically, the treatment facilities will consist of a grit removal chamber, comminutor, flocculation and settling tanks augmented by preaeration and chemical dosing equipment to aid flocculation. Also, provisions are made for pre-chlorination of the influent with post-chlorination of the effluent when required by river conditions. Sludge digestion tanks with exterior sludge heaters are provided, including gas collection equipment for the use of sewage gas for the heating of the sludge. Sludge disposal facilities consist of sludge conditioning equipment and vacuum filters with conveying mechanism for loading de-watered sludge onto trucks for final disposal.

This brief description by Robert C. Huddle, Supervisor, appeared in the Annual Report for 1960 of the Division of Water Pollution Control, Cincinnati, Ohio.

Water Pollution Control Based on Facts

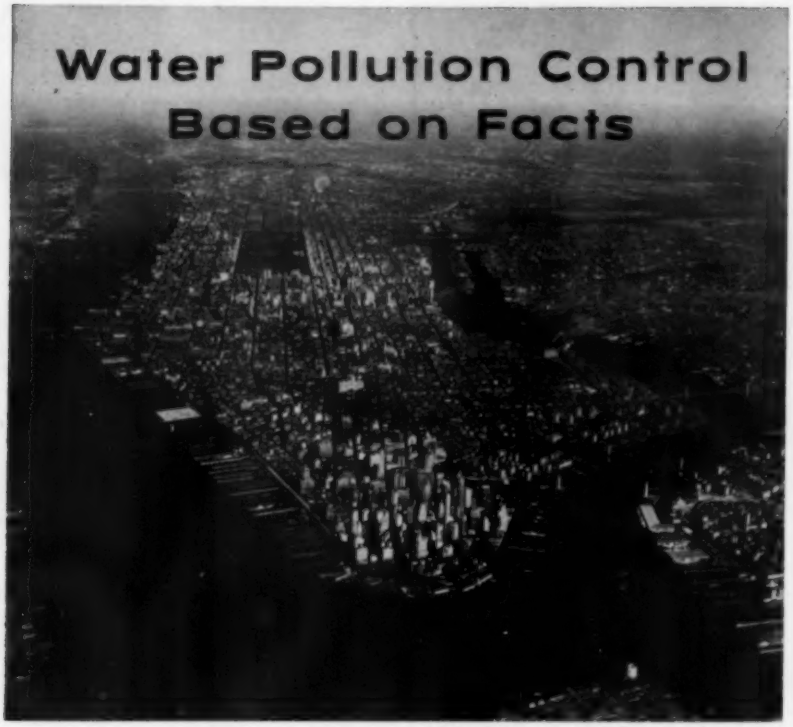


Photo courtesy The Port of New York Authority

THOMAS R. GLENN, JR.
Director and Chief Engineer,
Interstate Sanitation Commission

THE INTERSTATE Sanitation Commission was created by the States of New York, New Jersey and Connecticut for the abatement of pollution in the waters of the New York-Metropolitan Area. The waters under its jurisdiction are all tidal and pose a variety of problems not encountered in non-tidal pollution abatement work.

In trying to analyze data collected over a long period of time, with existing methods of analysis, wide variations as to the water quality were obtained. In some cases, no improvement could be demonstrated after a new sewage treatment plant had been placed into operation. This was obviously not because of lack of improvement but due to a non-sensitive method of obtaining and analyzing data.

In 1957, the Commission planned a survey of the Arthur Kill, separating New Jersey from Staten Island, approximately thirteen miles in length. It was decided to concentrate on running as many dissolved oxygen samples as possible and limit additional tests to salinity and temperatures so that the percent saturation of dissolved oxygen could be calculated. We used percent saturation instead of concentration of dissolved oxygen for two reasons. The standards of the Commission require that a certain minimum percent saturation of dissolved oxygen levels be maintained, eliminating the variables of temperature and salinity and therefore minimizing the variation in data.

Eighteen sampling stations were selected and each was sampled three times a day, four days a week, for five weeks. In plotting up the data for individual stations, we found that the dissolved oxygen from many of the stations followed the sinusoidal variation of the tidal current cycle. In a program of random sampling, samples are taken over a period of days and from many tidal current cycles of different lengths. This type of sampling is considered advantageous in that there is no attempt to sample one specific part of the current cycle. By sampling a given station at approximately the same hours each day, all phases of a current cycle are gradually sampled as the time of maximum ebb current changes continually. Thus, the percent saturation existing for all stages of the cycle will be observed in time.

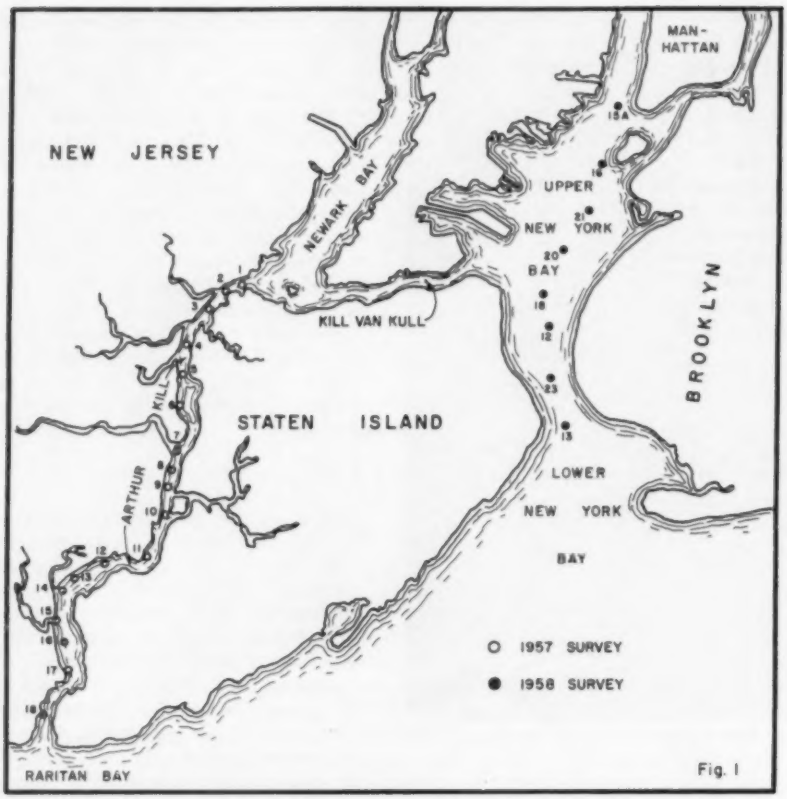
To reduce the observations from various tidal cycles to one common theoretical cycle, which has the distribution of a sine curve, it is necessary to refer all observations to the same current condition. The mean percent saturation of dissolved oxygen, under these conditions, occurs at the time of maximum ebb and flood currents. Here the maximum ebb current is used as the reference time. The lapse of time is determined between the time of observation and the time of the last maximum ebb current. This time is referred to as "t". The length of the particular current cycle is obtained from "The Current Tables of the Atlantic Coast of North America" and is referred to as "p." To place a particular observation on the sine curve, we use the expression,

$$\theta = \frac{t}{p} \times 360, \text{ in degrees.}$$

In a similar manner, a distribution curve is obtained to express all observations for each station on a common and comparable basis with each other. The graph of the observed data should be plotted with the percent saturation of dissolved oxygen as the ordinate and the number of degrees as the abscissa. The variation of the observed percent saturation is shown by such a graph for a particular station and, as considered thus far, is most accurately described by a sinusoidal curve of best fit. However, certain geographical conditions, tidal actions and concentrations of polluting materials may cause the distribution of observed data for a few stations to be best described by a straight line, parabola, or various combinations of curves. These curves or lines are determined by the method of least squares, and regression analyses are made to determine the significance of these lines of best fit. Thus, in processing the Arthur Kill survey data, a new method for analyzing observed data in tidal waters was developed by the Commission staff. (1)

Application of Method

An application of this new method of analysis for tidal waters may be shown by the results obtained from the Arthur Kill Survey. (2) The percent saturation values were found to vary with each station and the stage of the ebbing or flooding current. When the Raritan Bay is flooding, its waters flow northerly into the Arthur Kill. These waters were higher in dissolved oxygen than those in the middle portion of the Kill. When the Raritan Bay is ebbing, the waters in the Arthur Kill flow southerly into the Raritan Bay. With the flow going in this direction, some of the better waters



● **LOCATION** map shows sampling stations for 1957 and 1958 water area surveys.

from Newark Bay were drawn into the Arthur Kill.

Fig. 2 shows the weighted mean percent saturation of dissolved oxygen for a period of five weeks. At each of the stations, averages were found by the method referred to previously.

Fig. 3 shows observed hourly variations of percent saturation of dissolved oxygen during the ebb current phase. The curves of best fit were used to obtain percent saturation of dissolved oxygen values occurring simultaneously at other stations in the Kill. At the start of the ebb current, it may be seen that the dissolved oxygen is low between Stations No. 1 and No. 7, but as the ebb current proceeds through the fifth hour, the lower section has moved between Station No. 7 and No. 13. A graph for observed hourly variations of percent saturation of dissolved oxygen during the flood cycle phase would show movement of the badly polluted water northerly to its initial position.

It is apparent that a "slug" of polluted waters is oscillating back and forth in the Kill. The southernmost point to which this slug of pollution extended was Station No. 14. At the northerly end, an investigation of the tidal currents showed that the flood current carries Kill waters into Newark Bay for approximately six hours during the flood stage. During the last hour of flood current at Station No. 1 in the Arthur Kill, the waters were also being pushed across the lower end of Newark Bay into the Kill Van Kull. Also at this time the waters in the lower end of Newark Bay were ebbing out through the Kill Van Kull and into the Upper Bay. Thus the slug of pollution in the Arthur Kill is restricted or controlled by this continuous "sloughing off" of its northern end to balance the pollution which is continually discharged into the Arthur Kill. The hourly variation of percent saturation occurring throughout the Arthur Kill at specific times during the tidal cycle presents a clear picture of actual conditions. Graphs of minimums and maximums are artificial and would not have revealed the movement of the slug.

Fig. 4 illustrates the results of a 1958 survey of Upper New York Harbor. Each curve shows the vaiation of the weighted mean percent saturation of dissolved oxygen values through the main channel for three different BOD loadings. Note the smoothness of these average value curves and that they resemble the shape of the oxygen sag curve.

Set 1 curve is for the first five weeks of the survey. Due to construction work at one of the large treatment plants, untreated sewage was discharged to the Upper Harbor for two weeks. The curve for Set 2 shows the resulting conditions produced by the additional pollution.

Set 3 curve represents sampling shortly following resumption of operation of the plant and indicates partial recovery. This particular survey made it possible to predict future conditions with accuracy and gave a positive measurement of the effect of a definite amount of BOD, with the resulting change in dissolved oxygen content.

A regression curve was developed for the weighted mean values found in the Upper Harbor. In the future, it may be used with limited sampling to determine the conditions throughout the harbor. (3)

These illustrations have employed dissolved oxygen as the parameter for measuring pollution. Data obtained on BOD and salinity may be analyzed by the same method. Many stations exhibiting sinusoidal variations for dissolved oxygen, BOD and salinity fail to follow any pattern when using coliform data.

We are conducting surveys which we hope will produce a method whereby the assimilative capacities of tidal water areas may be more accurately determined. This would allow us to observe data and calculate directly the effect of the removal of a certain amount of BOD from a particular water area. Thus, a yardstick would be provided for determining the effectiveness of the pollution abatement program and aid in estimating any control required in an area.

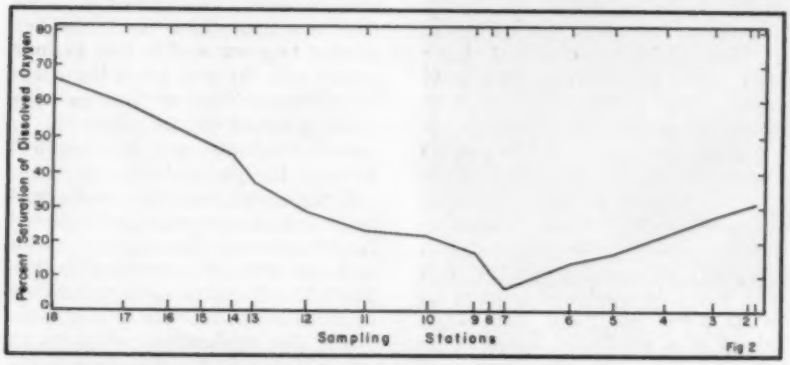
Future Sampling

The next step in obtaining sampling data should be to pick locations for installation of continuous sampling equipment, and proper locations for continuous sampling equipment cannot be made in tidal waters without the prior extensive surveys to obtain the overall characteristics of the water area. Limited sampling may permit erroneous conclusions: 1) By assuming sinusoidal variation for analyzing data when this type of variation does not exist, and 2) some stations will vary by as much as 50 percent saturation of dissolved oxygen during one tidal cycle. After the extensive survey, a limited number of continuous sampling devices will allow the control agency to calculate conditions in all

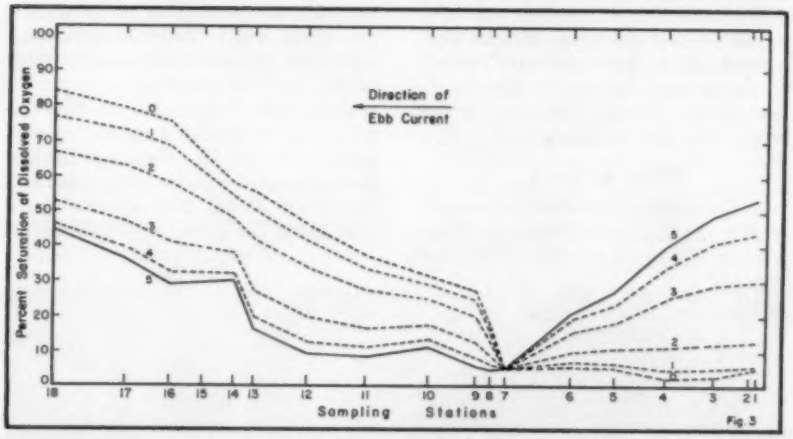
portions of waters under its jurisdiction.

How then would an interstate agency such as ours make use of information obtained by continuous sampling? Our standards are of the effluent type, and for domestic sewage treatment plants the requirements are spelled out in specific detail. The standards for industrial wastes include these specific conditions and are also covered in a broader way in other sections of the compact.

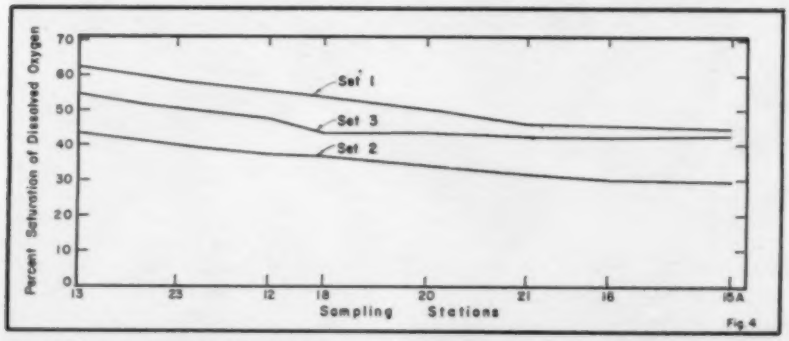
Since the commission is obligated to assure each of the participating states that the treatment plants within its district are meeting compact requirements, the sampling of treatment plants is one of our major activities. The results of these investigations indicate the effectiveness of the treatment plants and make it possible to detect those that have become obsolete or overloaded. Corrective measures may then be taken to insure their continued compliance with our effluent standards.



● **ARTHUR KILL SURVEY, 1957. Weighted mean percent saturation of dissolved oxygen. Sampling stations extended from Raritan Bay (left on curve) to Newark Bay.**



● **ARTHUR KILL SURVEY, 1957. Observed hourly variation of percent saturation of dissolved oxygen shows the presence of an oscillating "slug" of polluted water.**



● **UPPER NEW YORK HARBOR SURVEY, 1958, showing weighted mean percent of dissolved oxygen. The three sets of data reflect initial conditions, the effect of discharge of untreated sewage into the harbor, and finally partial recovery.**

Continuous sampling devices for water areas will provide the information not only as an aid to determining the amount of treatment needed by communities and existing industries in the areas but for future industries. This continuous monitoring also would be of great value in detecting bypassing of treatment plants or any other important source of pollution. In some cases, it may be proper to use some type of device that will pick up samples periodically throughout the day for analysis later in the laboratory.

In determining the facts on a community or treatment plant that is not meeting Compact standards, a portable continuous sampling device would be of great value if it were installed at such a plant for a period of several days. This would be an application of a continuous sampling device which is quite different from the previous use for water area surveys.

Our commission could make good use of some device or type of instrumentation less complicated than the continuous sampling type for use by our field men in routine plant sampling. Several ideas are now being considered for such sampling procedures.

State and interstate control agencies must spend a certain amount of time on applied research of their particular area. This requires an extensive survey of their water areas which may be divided into subareas based on local conditions. This may be followed by the location of continuous sampling equipment at strategic locations throughout the area under their jurisdiction. Even with continuous sampling, an intensive survey may be necessary after major changes of pollution abatement have occurred in a particular case. A pollution abatement and control program with such a basis will bring about cooperation by municipalities and industries.

References

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2. 1958 Annual Report of Interstate Sanitation Commission. "Survey of Arthur Kill Waters." 18-29
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This article was condensed from a paper presented before the Symposium on Water Quality Measurement and Instrumentation, August, 1960, sponsored by the Public Health Service, Cincinnati, Ohio.

Chemical Approach to the Roadside Grass Maintenance Problem

WILLIAM C. GREENE
Landscape Engineer
Connecticut State Highway Department

STATE HIGHWAY departments are faced today with staggering roadside grass maintenance costs. With highway construction on the rise, and the use of interchange areas with their large grass plots, many states are spending well over $1 million yearly to keep roadsides trimmed. Concurrent with this cost problem, superhighways with their higher speed limits are making the task of mowing areas close to roadways increasingly hazardous.

Twelve years ago the Connecticut Highway Department started a program aimed at lowering grass mowing costs and also increasing the safety for its mowing crews. Out of this work has come a maintenance technique which our department has now tested for about a decade, and recently adopted as a valuable maintenance tool. This is a report on the program, and the technique of "chemical mowing" to which it led.

Chemicals and Equipment

The chemical is maleic hydrazide (MH-30), a development of the Naugatuck Chemical division of United States Rubber Co. A plant growth inhibitor, it was discovered by the chemical company in 1947 at its laboratories here in Connecticut. Starting in 1950 we began to test it for grass growth control application on approximately 400 acres of roadside grass throughout the state. These experiments were continued for nine years, and then greater use began three years ago.

Over the past three years it is estimated that we have chemically controlled grass growth on a total of 2,200 acres. Much of this has been on difficult-to-mow or hazardous areas. Through the use of the chemical we have been able to reduce the frequency of mowing, and the substitution of a spray truck for mowing crews has increased the safety of our operation.

Numerous ways of applying the growth-inhibiting chemical have been tried during our period of experimentation. The most effective means has proved to be a high-capacity sprayer with a delivery of 50 gallons per minute at a nozzle pressure of 20-to-35 pounds. The nozzles used are the off-center type.

A truck equipped with such a sprayer can be operated by two men, and it is capable of treating up to 50 acres per hour and being driven at a maximum speed of 15 miles per hour. On calm days, such a sprayer can throw an even spray up to 35 feet.

We have also found that the efficiency of this operation can be improved if a 1,000-gallon "nurse" truck is used in conjunction with the spray truck. This minimizes down time for refilling.

When to Spray

In Connecticut the first two weeks of May, or the period between September 15th and October 15th, are the most effective times to apply the chemical. The spring application is made when the grass has started to grow and is two to four inches tall. At this point the grass is sufficiently high so that an adequate amount of the chemical to induce inhibition can be absorbed through the young blades of grass.

If the spring treatment is delayed beyond that point, the grass should be treated and then mowed about a week after the chemical is applied. The chemical's effect will then be evident on the rate of regrowth.

The fall application, which is an alternate method rather than a required follow-up to spring use, should be made before the grass becomes dormant. The grass plants will then retain the chemical, and its inhibiting effect will be apparent in the following season.

Either the fall or spring method will give satisfactory inhibiting results. Use of the chemical during the summer months, by contrast, has been found less effective. At that time the grass is usually dormant, particularly during dry spells,

● **APPLYING grass growth inhibitor to a roadside area. One truck can treat up to 50 acres per hour with a crew of two. Fall and spring applications have proved best.**

and the rate at which the chemical is absorbed into the plant is substantially reduced.

In the case of fall treatment the chemical will result in prolonging the natural dormancy period. Sprayed grass will not appear to be actively growing for one to two weeks after the normal start of vegetation.

Results and Costs

The Connecticut Highway Department is currently spending a large percentage of maintenance funds to mow approximately 12,000 acres of grass. Highway medians are normally mowed 12 times during the growing season and roadside shoulders are trimmed several times.

The chemical growth inhibitor has been particularly effective in reducing costs along stretches of the Connecticut Turnpike. On the fill areas through urban sections of the Turnpike, use of the chemical has reduced the necessity for mowing. For three years we have been controlling the growth of the grass in many of these areas with either fall or spring applications.

Prior to the use of the chemical, these slopes were mechanically mowed at a cost of approximately $70 per acre per mowing. This high cost encouraged use of the inhibitor and resulted in approximately fifty percent savings.

We are not currently treating median strips with the chemical, although they are the most hazardous areas to mow. Median strips can be sprayed with the growth inhibitor from a truck in relative safety. Our tests also indicate that use of the chemical can substantially reduce the number of median strip mowings.

Connecticut's experience with MH-30 over the past 12 years indicates that this chemical can aid highway departments in reducing grass mowing costs particularly on hard-to-mow and frequently-mowed grass areas. It is also obvious that in addition to cost reduction this material will make roadside grass maintenance practices a much less hazardous operation. □□□

● **RESULTS of application are shown by comparison between untreated area on the left and area on the right. Inhibitor applied in the spring; picture taken in July.**

● **THIS VIEW shows a roadside section in an urban area; treatment was applied in the spring and the photo taken in late July.**

ARE DOMESTIC SEWAGE LAGOONS SAFE?

H. O. HALVORSON
Director, School of Life Sciences,
University of Illinois,
Urbana, Illinois

AN ARTICLE in *Reader's Digest* for July, 1960, entitled "Nature's Wondrous Way With Waste" by Don Romero, Assistant Professor of Journalism, University of Missouri, advocated open sewage lagoons as a panacea for the treatment of raw domestic sewage. It is claimed that this is the most economical method that can be used and that it is perfectly safe. The statement made is not backed up with documentary evidence; the author merely says he received his information from a representative of the Public Health Service and that the process is being promoted by someone from this group. Unfortunately the article probably was widely read and respected because the printed word carries with it a certain amount of authority, expecially so when the statements made carry the concurrence of presumed experts.

I challenge the assertion that open sewage lagoons that receive untreated domestic sewage are safe from a public health point of view. I am not aware that anyone in the Public Health Service or elsewhere has shown that such lagoons are free from disease producing bacteria. When the statement is made that these lagoons are perfectly safe, even though they may be only a few hundred feet from homes, churches, and other public places—the public will logically assume that the action within the lagoon renders the water free from pathogenic organisms. In fact, the waters in these lagoons can and most often do, carry disease bacteria; this is one reason the state boards of health and public officials specify that such lagoons must be constructed at least a quarter of a mile from residences or public frequented grounds.

When raw sewage is discharged into a quiet pond of water such as a shallow lagoon, the larger solids will settle to the bottom near the point of discharge and here will undergo decay (as was mentioned in the article in the *Reader's Digest*). Very small particles and bacteria will remain in suspension for a comparatively long period of time and therefore will not be in the environment where the worms and other forms of life digest the settled organic matter. In a mechanical sewage treatment process the principal fact in the destruction of disease producing bacteria is the competition exerted by other micro-organisms growing in and on suspended organic matter. In treatment processes such as the activated sludge system, the aim is to keep the organic matter suspended so as to increase the activity of the organisms thus allowing them to consume the finely divided organic matter—including the disease producing bacteria — that does not readily settle. In a quiet lagoon this situation is not attained; here the bulk of the organic matter settles to the bottom and the finely divided material and the majority of the free living bacteria will remain in the semi-clear water for a considerable time. In fact, these adventurous bacteria are likely to live longer here than in the environment of a mechanical sewage treatment process. Viruses are even smaller than bacteria, so will settle even slower and are apt to remain in suspension in the water for even longer periods of time.

In sewage contaminated waters, it is virtually impossible to devise tests that are sufficiently reliable to reveal the presence of disease producing bacteria even when they are known to be there. Any competent bacteriologist will admit that negative results in such tests is no indication that these bacteria are absent; therefore, one cannot rely on tests of this kind to prove that lagoons are safe. When it comes to viruses, our testing methods are woefully inadequate and the situation is even worse, particularly in view of the many new species that are constantly being discovered. Sanitary bacteriologists have always had to rely upon the findings of harmless indicator organisms to ascertain whether or not a body of water is likely to be free from disease producing organisms. Some bacteriologists in Europe have used a culture of *Seratia indica*, a particularly easy to find harmless bacterium, to determine the degree of contamination of a river or lake.[1] This organism is not ordinarily found in natural waters and it is very easy to identify because it produces a red pigment when it grows. I would suggest that others interested in such studies use this method to determine how widespread the test organisms will be found in the lagoon and how long they will persist there. This will give some indication how long pathogenic bacteria might be able to exist in these waters.

What does it matter if disease producing bacteria are present in the waters of these lagoons? State boards of health require that such lagoons be surrounded by a man and pet proof fence. They also require that signs be placed in prominent places to warn people that these lagoons contain raw domestic sewage. I doubt very much that one can build a fence that can keep out curious boys and their dogs. Water

(*Continued on page* 210)

Dr. Halvorson is an engineer and also holds a doctorate in bacteriology. He has been a professor of microbiology and has engaged in research in that field for over forty years. His contributions to sanitary science have included some of our fundamental concepts of oxidation of sewage by trickling filters. A leading antagonist in the controversy over lagoons vs. mechanical sewage treatment facilities, he has offered this rebuttal against arguments for sewage lagoons appearing in a recent issue of a lay magazine. Readers who wish to comment are invited to address their remarks to Dr. Halvorson.

—Editor

Photos courtesy Ridgewood NEWSpapers

● **"BIG SWEEP" in Ridgewood collected 24,900 cu. yds. of leaves or 1 cu. yd. per person. Three sweepers and four front-end loaders made an effective removal team.**

Planning Makes Leaf Removal A Notable Success

M. J. SEELEY

Village Engineer,

Ridgewood, New Jersey

RIDGEWOOD IS A village of approximately 6.3 square miles, on which an estimated 175,000 trees flourish, of which over 30,000 have been planted by the Shade Tree Department adjacent to the sidewalk area. Because of the great concentration of trees, the Village was draped in a pall of smoke for a month or more each Fall as the public disposed of the mountains of leaves in the easiest fashion, creating a serious fire hazard and damaging the bituminous concrete or penetration macadam pavements which blanket the Village.

In 1958 it was determined by the Public Works Department that a complete leaf removal program would be tried on an experimental basis to eliminate the smoke problem and its accompanying ills. The department has now completed its third year of full scale operations and feels that most of the problems which such a program creates, have been successfully resolved.

Because of its newness and the lack of public information, the full impact of the program was not felt until the second year of operation. That second year, one in which the leaves hung on until much later than normal then all fell at once to be closely followed by rains and frost, was a nightmare for the department. A complete analysis of the weaknesses of the system was made at the end of 1959 and by the 1960 season our program was developed as follows. Newspaper articles outlining the objectives and procedure of the program were introduced several weeks in advance of the beginning of the program.

Table 1—Summary of Ridgewood Leaf Removal Program

Population (approx.)	25,000
Miles of streets	94
Total cu. yds. collected	24,900
Total cost	$14,210
Cost per cubic yard	$0.57
Cost per capita	$0.57
Number of men	18
Times entire town cleaned	5
Maximum days between pickups	10

The 94 miles of streets in the Village were broken down into six sections, and boundaries of the sections were established and published several times for public information. A "collection schedule" was published each week in the local paper, giving the day of collection by sections and descriptions for one complete collection of the Village each time a schedule was published, and asking residents to try to avoid raking leaves into the gutters more than forty-eight hours in advance of scheduled collections. This was to avoid the appearance of leaf-littered streets which occurs without control of any kind.

It had been previously determined that the inability of the department to meet published schedules the previous year, had led to confusion and finally lack of cooperation by the public, so it was decided that the entire Street Department crew would be used for the program and the crew would work overtime and/or Saturdays if need be to see to it that the schedule was closely followed. We worked a ten-hour day for most of the crew throughout the program and also had to work three extra days to maintain the schedule when rain caused delays in the program. However, despite six days of rain the department never was more than one-half day behind the printed schedules. Because of this, newspaper comment was favorable throughout the program and public cooperation was excellent. The Village streets were well cleaned and the work accomplished was very commendable, giving rise to much written and verbal praise—a rarity in this field.

The system which we evolved was briefly this: Three sweepers equipped with leaf rakes were sent out one hour in advance of the bulk of the crew. Then four front-end loaders, including one small loader borrowed from the Shade Tree Department, six 8-cubic yard dump trucks with sideboards for greater capacity, and one rented 20 cubic yard dump truck were sent out to start loading the leaves which previously had been piled by the sweeper-rake combinations at approximately one block intervals. One vacuum loader was also used for streets having either deep irregular gutters or earth shoulders unsatisfactory for sweeping. The loaders worked in pairs since it was found that a large bucket and a smaller bucket pushing towards each other from opposite sides of

the pile would give bigger loads for each bite without excessive spillage. The smaller bucket actually slid partly into the bigger bucket and then both buckets were raised simultaneously. A truck then backed between the two loaders which loaded from both sides of the truck, using the buckets to pack the leaves into the dump body.

When the trucks were loaded they made the trip to whichever of the three Village dumps had previously been determined to give the shortest round trip for each section. The Village nursery used approximately 5000 cubic yards of the leaves to create leaf mold, used throughout the municipal park system.

It was decided that all the equipment being used for the program, which included three sweepers, four front end loaders, seven trucks, one vacuum loader and one bulldozer, would have to be maintained and repaired at night so as not to interfere with the tight schedule. This was done for the six weeks that pickups occurred. There were various major repairs necessary during that period, but Village mechanics kept all the equipment constantly on the road except one loader which was out of service for a couple of days for a new transmission and was replaced by a rented loader so as not to create a bottleneck in the operation. The department insisted that no pile of leaves accumulated by the sweepers or loaders be left overnight. Leaf piles inevitably invite children to play and conceivably could result in an injury or death as a car rolled over or through a pile of leaves in the evening or late afternoon.

A daily check was kept of the number of loads carried by each truck and upon completion of five complete rounds of the town covering a six-week period from October 17 to November 29 it was determined that approximately 25,000 cubic yards of leaves had been collected, picked up and disposed of during the 1960 season. The total cost of the program including regular and overtime pay for all men in the street department and mechanics, repairs and maintenance for all equipment used, rental equipment, and one-quarter of the cost of three leaf rakes for the sweepers (assuming a minimum life of four years for each) came to $14,210. Converting this to the cost per cubic yard basis, it ran 57¢ per cubic yard.

Conclusions

In order for any public works department so carry out a successful leaf removal program, without undue financial strain on the community, a comprehensive approach must be used. Good public relations work is vital to the success of the operation. The help of the local newspaper is needed in publicizing the objectives and the schedules for the program. Published schedules must be closely maintained to keep public cooperation in not loading up streets just after they are swept clean. All men in the program must be convinced of the necessity for meeting the schedule in spite of any obstacles of time, weather, or equipment trouble.

● **VACUUM loaders were used to remove leaves from streets with irregular gutters and from other areas where sweepers could not work satisfactorily.**

The most efficient method of operation is to send out the sweepers equipped with leaf rakes in advance of the loaders, using the sweepers in tandem to give broom-clean streets, then using loaders in pairs to load dump trucks from both sides. Vacuum loaders should only be used on those streets whose gutters or shoulders make it impossible to be cleaned by the sweepers, since vacuum loaders are slow and of very limited capacity.

Any department contemplating a leaf removal program should be prepared for a substantial break in other normal operations due to the concentration of men and equipment needed to do an adequate leaf removal job. □ □ □

PLASTIC TRICKLING FILTER MEDIA

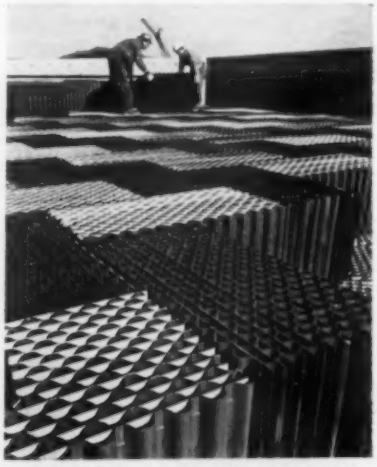
THE WORLD'S first trickling filter made of Koroseal rigid vinyl plastic, designed to minimize industrial waste, is in operation at the Kraft Company plant in Rome, Georgia, one of the nation's largest pulp and paperboard mills.

The new 100,000 cubic-foot trickling filter plant is three stories high and contains about 370,000 pounds of rigid Koroseal vinyl preformed into 6,250 filtercomb-like units or packs, manufactured by B. F. Goodrich Industrial Products Company.

The vinyl filtercomb units perform the same function as broken rock or tile in conventional trickling filter beds. Filter plants can be built vertically because the structural strength of the vinyl and the design of the filtercomb make it possible to stack the units one on top of the other, to heights of 30 or 40 feet or more.

The Rome unit is octagonal in shape, with walls constructed of concrete block and contains ten layers of the Koroseal units. The packs are arranged at right angles to each other to give maximum structural strength. The surface area provided by the filtercomb design—40 square feet of surface for every cubic foot—provides a large area for bacterial growth. Its open construction insures rapid oxidation.

While this first vinyl-cored plant was designed specifically for pulp and paper waste, the same principle shows great promise for municipal sewage treatment and in other industries.



● **PLACING vinyl filtercomb media.**

The Influence of COMBINED SEWERS on Pollution Control

HAROLD ROMER
Director, Bureau of Sanitary Engineering, New York City Department of Health
and
LESTER M. KLASHMAN
Regional Program Director, Water Supply and Pollution Control, Regions 1 & 2, Public Health Service U. S. Department of Health, Education and Welfare

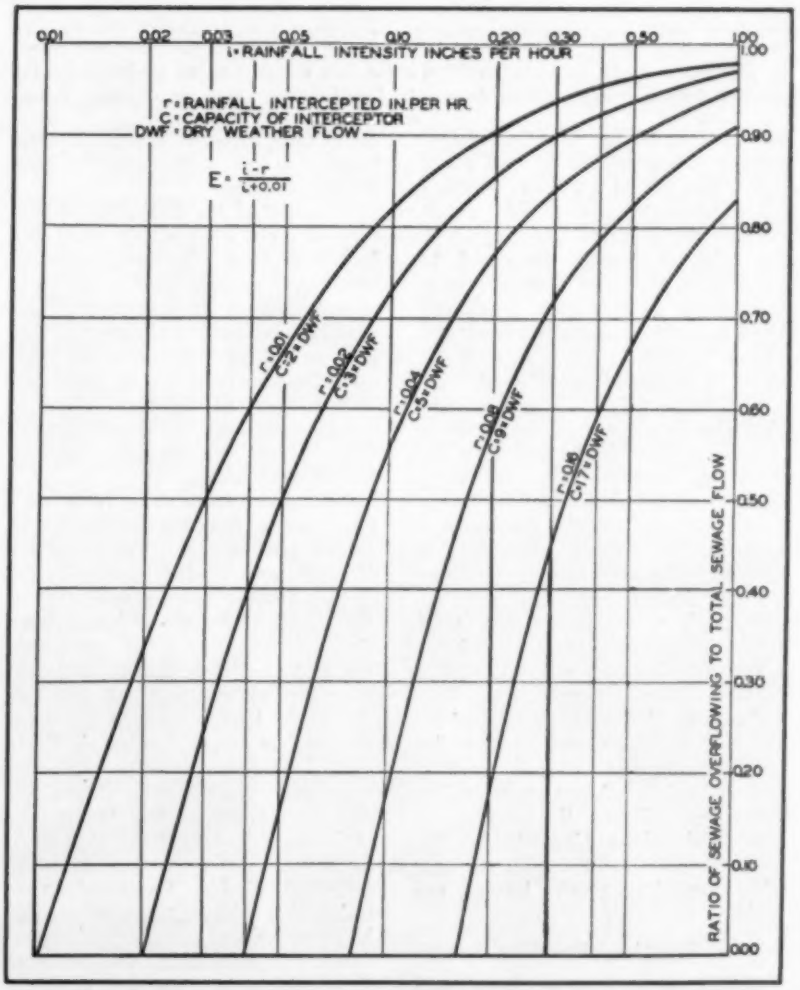
THE OFT-REPEATED statement that only 2 or 3 percent of the total flow of sewage is discharged untreated from combined sewer systems has led to a feeling of complacency and assurance that certainly "so small a percentage can hardly cause pollution." Nevertheless, combined sewers have been implicated in the perpetuation of pollution despite the construction of sewage treatment works.

McKee (1) has shown that in a combined sewer system in which the interceptors are designed for twice the average dry weather flow, approximately 67 percent of the untreated, raw sewage is discharged via overflows during periods of precipitation as little as 0.05 inch per hour, Fig. 1. Various sources indicate that little is to be gained, in general, by designing a combined sewer interceptor with a capacity greater than twice the average dry weather flow or peak dry weather flow. Others disagree.

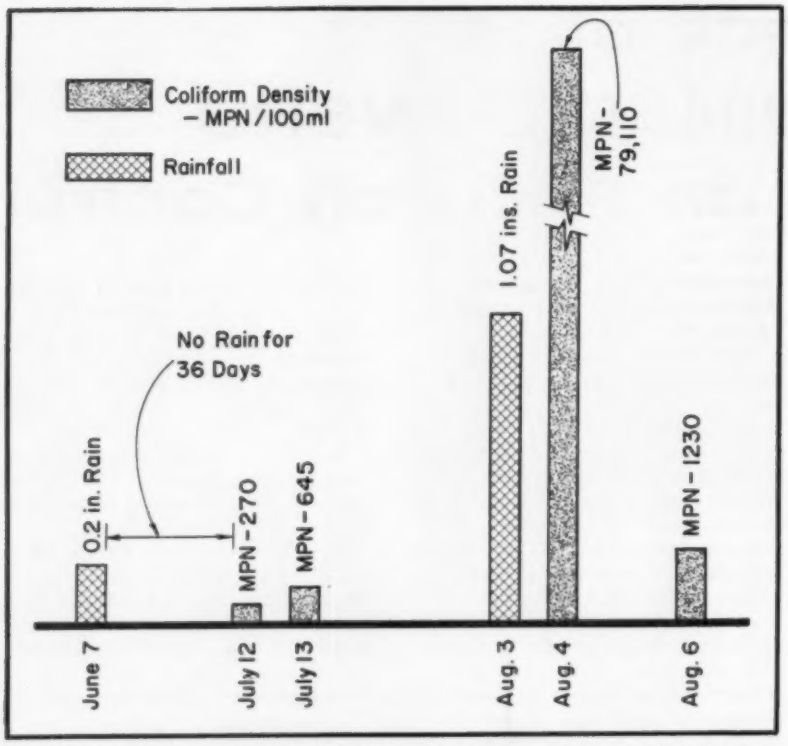
Combined sewer overflows are generally located at or near the shoreline and during periods of discharge will often grossly pollute waters which may have satisfactory dissolved oxygen and bacteriological characteristics during extended periods of dry weather. In smaller streams, or where there are several towns and cities using combined systems along larger streams, the effect of combined sewage overflow may persist for several days. This is equally true in tidal waters particularly where the overflows discharge into bays or sluggish canals. The discharge of the untreated sewage at the water's edge often results in the movement of the sewage en masse along the shoreline. As a result, the benefits of available dilution are not obtained. When we consider that in many parts of the country, rainfall in excess of the rate of 0.05 inch per hour occurs twice during each summer week, it is readily seen that the pollution created by the overflow of raw sewage may result in the continuity of pollution since, in many instances, there is insufficient time for the waters to recover between periods of overflow.

An interesting and perhaps classical example of the effects of combined overflows is seen in Jamaica Bay, a tidal inlet approximately 5 miles by 5½ miles in size connected to the Atlantic Ocean by a channel at the southwest corner. Four activated sludge sewage treatment plants treat virtually the entire dry weather flow from an area occupied by about 1.25 million persons. The effluent is chlorinated during the bathing season.

Fig. 2 shows the results of a study at Canarsie Beach, located on the north shore of Jamaica Bay. During an unusual period (36 days) of no rainfall, the coliform density



● **FIGURE 1. Ratio of sewage overflowing at various rates of interception.**



● **FIGURE 2. Study conducted in 1954 shows how storms causing combined sewage overflow influence the coliform density in Jamaica Bay waters at Canarsie Beach.**

was at the lowest recorded figure, MPN 270. On August 3, 1945 there was a rainfall of 1.07 ins. Samples taken on August 4 yielded a log average MPN 79,110. By August 6, the coliform density decreased to MPN 1230. Coliform densities vary extensively in this area depending upon periods between precipitation. The average is in the area of MPN 10 to 20 thousand per 100 ml.

Obviously, it is desirable to eliminate or to reduce the quantity of raw sewage discharged into the receiving waters from overflows. The first thing that must be determined is whether the interceptors and overflow weirs are adequate to prevent the discharge of raw sewage during peak dry weather flows. Often, the accumulation of solids will result in a significant reduction of sewer and interceptor capacity. The raising of overflow weirs may eliminate overflow during dry weather and reduce the frequency and volume of overflow during periods of low precipitation rates by utilizing the sewers as storage chambers. Nevertheless, the problem of overflow during and after precipitation will largely remain.

American Practice

Combined sewers are employed in more than 1400 municipalities in the United States having a total population of approximately 50,000,000 persons.

A review of the American literature reveals remarkably little information about the composition of combined sewage and even less about methods of treatment. Correspondence with a number of engineers and city officials in the USA and Canada resulted in little information as to the composition of combined sewage but it was learned that several cities do employ stormwater tanks.

Columbus, Ohio, has been employing standby stormwater tanks for the past 30 years. The tanks are of sufficient capacity to hold the total combined flow of only part of the storms. Chlorination is not practiced. Treatment plant personnel are of the opinion that a good deal of pollution which previously occurred in the river during normal storms has been eliminated. Some difficulties have been experienced with odors particularly during the spring cleaning of the tanks. The tank washing operations also place a "terrific load" on the municipal activated sludge treatment plant unless the cleaning procedure can be stretched out over a week or so. However, extending the cleaning time increases the odor problem. Covering the tanks may reduce the odor nuisance but this is very expensive.

The North Toronto sewage treatment plant, built in 1928, serves an area of approximately 3,000 acres, and the trunk system leading to the plant is of the combined type. Throughout the whole system there are no storm overflows. Just upstream from entrance to the primary tanks a weir is operated which allows sanitary sewage to enter the plant structures, with storm water over 2½ times the dry weather flow being diverted to the storm tank system. The tanks are quite elaborate and are equipped with a crane for the removal of the very extensive amount of grit which enters them during periods of storm flow. The structure has served a useful purpose. It is rather expensive to operate, since there are several periods of rain in the course of a year.

Over 40 years ago, a storm water detention tank was built on a combined sewer which serves a large area called High Park in the west end of the city, to reduce the flow in a former storm sewer which extended from the tank southerly to the lake outlet. Over the years this tank has been very expensive to operate because a considerable amount of sanitary sewage tends to accumulate therein, requiring excessive labor to keep clean.

No storm tank construction has been considered in the new $120 million drainage program presently under way. All new sewers in the area are of the separate system type.

British Practice

British cities have been employing stormwater treatment tanks for many years and their Engineering practice generally employs the combined sewer design recommendations of the Royal Commission on Sewage Disposal. As revealed from extensive correspondence with British engineers, scientists and administrators, a brief summary of these design recommendations follows:

1) The level of sewer overflow weirs is generally designed to retain up to 6 times DWF (dry weather flow). Whereas American overflow weirs are generally designed to discharge at 2 or 3 times average DWF. British practice may design the weirs to retain as much as 8, 10 or even 14 times DWF. The higher settings are employed, for example, on fishing streams where dilution by stream water is inadequate. It should be noted that British stream flows generally are

much less than those in the USA.

2) Flows up to 3 DWF are given full treatment at the regular municipal sewage treatment plant.

3) Flows between 3 and 6 DWF are given partial treatment in stormwater tanks. Partial treatment consists of sedimentation only with discharge of excess into the receiving stream. Remaining supernatant is passed to the regular treatment plant for full treatment after cessation of storm flow.

4) Excess above 6 times average DWF is discharged to a receiving stream without treatment. Dempster of Scotland (3) indicates that the 6 DWF setting of the overflow weir is satisfactory where dilution provided by the receiving stream is greater than 300 times the combined overflow; for dilutions 8 to 300, the setting should be 12 DWF; for dilutions less than 8, the setting should be 18 DWF. Because of the relatively low-flow British streams, dilution requirements of regular sewage treatment plant effluents are stringent. Normally, where dilution with good river water is at least eight fold, treated effluent should contain not more than 30 ppm suspended solids and 20 ppm BOD.

5) Overflows on branch sewers should be used sparingly.

6) Screens (6-in. and 1-in. openings) and constant velocity grit chambers generally precede the stormwater tanks to reduce the tank cleaning problem. Screenings are macerated and pumped upstream of the screens. Stormwater tanks, at least two in number, should have a minimum capacity equal to one half of a day's average dry weather flow. It is felt that the tanks should have at least a two-hour detention period at the maximum combined flow to provide satisfactory sedimentation. In addition to giving the combined sewage a longer period of detention, this would reduce the incidence of discharges to the river from the stormwater tanks. Some designers consider it advisable to provide an extra stormwater tank to receive the first flush of the storm since this may contain a very high suspended solids and BOD load. None of the supernatant from this tank is permitted to be discharged to the receiving stream (4).

Stormwater tanks generally are rectangular in shape, though some circular tanks have recently been installed in Britain. Sludge is generally removed by dewatering the tanks and using manual squeegees or squeegees mounted on a small tractor. The sludge is pumped to the treatment plant digester. Mechanical sludge collectors may be used.

In response to our inquiry about the efficiency of combined sewage treatment methods, we were advised that the "impurity content" of combined sewage is reduced one-half to two-thirds after sedimentation in stormwater tanks for a period of eight hours (5); individual results vary "enormously." Our British correspondents also advised that:

1) Supernatant pumped from stormwater tanks to the regular treatment plant (including activated sludge plant) presents no problems provided the pumping rate is adjusted to give suitable loading (6);

2) Tank sludge pumped to regular digesters is a satisfactory procedure;

3) When sludge is pumped into the influent end of the regular treatment plant, primary clarifiers and subsequent biological processes are often upset (6);

4) Tanks should be desludged frequently; preferably after each rainstorm;

5) "Owing to delays in removal, sludge in tanks may become odorous" (6);

6) There is no known problem with odors from sludge since it remains in the tank for a short time (7);

7) "Serious pollution would have resulted had it not been for the protection given by the stormwater tanks" (5);

8) "This whole problem of combined sewage overflow is a very serious one for which there is no simple solution" (8);

9) "Impounding stormwater is a good scheme" (9);

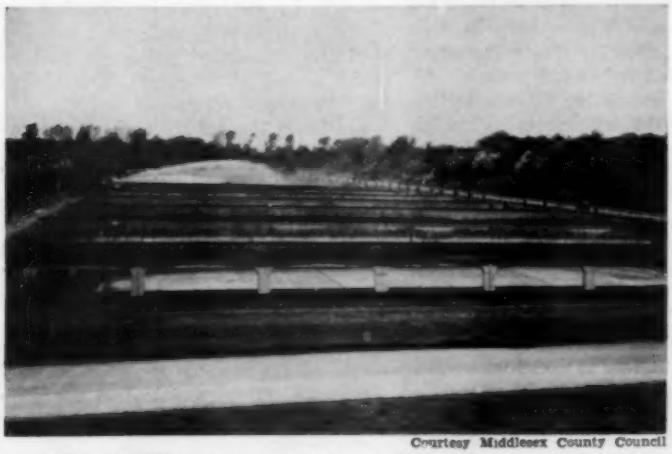
Use of Chlorine

No information could be provided with reference to the influence of stormwater tanks upon the coliform densities in the receiving waters. Unlike the US, Great Britain does not employ bacterial standards for its natural waters. However, one correspondent notes the tendency toward this direction. In response to our statement that chlorination of combined sewage in stormwater tanks is being considered in the US, we were advised that:

1) Neither normal treatment plant effluent nor stormwater tank effluent is chlorinated in British practice;

2) "Disinfection is effective only on the outside surfaces of the solids which can be immediately reinoculated when they reach the receiving water." (8);

3) "When working on emergency water supplies during the war, 50 ppm chlorine for one hour was not effective when suspended solids equaled 50 ppm." (9);



Courtesy Middlesex County Council

● **STORMWATER tanks at Mogden, England, West Middlesex Main Drainage Works. Pumps under test in rear indicate size of area.**

Courtesy North Surrey Joint Board

● **STORMWATER tanks provided at the Hogsmill Valley Works. Photo shows some design details.**

4) "We have no evidence to support the hypothesis that chlorination of stormwater would be a worthwhile project." (10).

The ability to disinfect sewage with chlorine is related to the composition of the sewage, mainly the suspended solids concentration. Whereas the BOD and chemical composition of the sewage will influence the required chlorine dose, high concentrations of suspended solids, especially clumps, can result in the failure to kill organisms in sufficient number due to the known inability of chlorine to penetrate solids. The suspended solids content of sewage, therefore, is basically the controlling influence in the disinfection process. If sufficient suspended solids can be removed by sedimentation or if thorough comminution of solids were practiced, it is conceivable that the supernatant might be amenable to the action of chlorine.

The suspended solids data on combined sewage in Sheffield, England, during a storm (0.11 in. of rain) as reported by Klein (2) are given in Table 1.

Samples of combined sewage taken from 11 stormwater tanks after treatment contained suspended solids, as follows: Minimum 60 ppm; average 300 ppm; and maximum 950 ppm.

If we assume 60 percent removal of the suspended solids in the stormwater tanks, the average SS content of the untreated combined sewage is 750 ppm or more than twice that in dry weather flow.

Klein also reports in Table 2 the SS in Heywood (England) combined sewage resulting from heavy rain lasting 4 hours.

It is interesting to note that after 4 hours of heavy rain, the SS were in excess of concentrations normally present in dry weather flow.

Daviss (5) reports on combined sewage treatment in small towns and notes that the mixture may have a maximum BOD of 986 ppm 4 hours after commencement of the storm after prolonged dry weather; a minimum BOD of 30 ppm during a wet period; combined sewage is weak if the storm occurs in early morning hours and strong if the storm occurs during peak morning flow. He reports overall averages for small plants for a 2 year period, 1958 and 1959, as follows:

BOD of average DWF, 215 to 294 ppm; of average combined flow, 128 to 235; and of average tank effluents, 44 to 95. The suspended solids ranged from 245 to 272 for average DWF; 197 to 250 for average combined flow; and 76 to 80 for average tank effluent.

Dempster (3), referring to experience in Scotland, reports the composition of "first flushes." These had an average SS 300 to 400 ppm (equal to dry weather SS); and a peak of 2,045 ppm. The BOD equaled one-half the SS.

Burgess (9) reports the composition of London combined sewage. (London does not employ stormwater tanks). Over a 2-year period (1959-1960) the Northern outfall showed BOD ranging from 138 to 451; SS from 166 to 617; and flow in mgd from 165 to 302. At the Southern outfall, the BOD ranged from 114 to 384; and the SS from 117 to 393; the flow was from 74 to 180 mgd.

Analysis of the combined flow from 18 English cities indicated that SS averages varied from 147 to 685 ppm. One town yielded an average SS of 2676 ppm. BOD's averaged 40 to 230 ppm with a 400 ppm average for the town with the high SS.

The Ministry of Housing & Local Government (11) reports on the quality of the stormwater overflow at Brighouse in Table 3.

Klein (2) aptly summarizes the paradox of permitting combined sewage to pollute the waters where dry weather flow is treated. "It does on the face of it seem illogical to require a fairly strict standard of purity for a sewage effluent during dry weather and to have no standard at all for part of the flow during a storm. It could be argued that dilution of a stream during heavy rain might offset any pollution caused by storm water sewage or storm overflows but in practice it is found that the river during flood conditions is often in a worse state than during dry weather. In this connection, Clay, a rivers inspector of long experience, writes: 'A somewhat disquieting feature in this country is the fish mortality which occurs as a result of storm, particularly those following long periods of dry weather creating intense waves of pollution during which the water might be almost totally devoid of dissolved oxygen and contain an abnormally high amount of suspended solids.'"

Examination of the above data can lead but to one conclusion. The composition of combined sewage is extremely variable, varying from tributary area to tributary area and probably with intensity and duration of rainfall as well as time of day. Data could not be obtained with reference to variations in composition vs. intensity and duration of rainfall. Reduction of suspended solids by sedimentation depends on the composition and concentration of the suspended solids as well as the period of detention. The ability to disinfect combined sewage depends on the nature and concentration of the suspended solids.

The purpose of treating combined sewage is to protect the receiving waters for the highest legitimate uses and to protect the investment in the municipal sewage treatment plants which safeguard the waters during dry weather. American engineers are now reconsidering the use of stormwater tanks to control organic and bacteriological pollution resulting from combined sewer overflows.

It is obvious from the above data that there is not likely to be any

Table 1—SS Content in Combined Sewage at Sheffield, England, with 0.11 inch of Rain

Time	SS, ppm
10:50 am*	592
11:50 am	602
12:50 pm	671
1:50 pm	1,701
2:50 pm	1,259
3:50 pm	1,335
4:50 pm	1,012
5:50 pm	1,006
6:50 pm	979
7:50 pm	417
8:50 pm	401
9:50 pm**	263

Note: *Before rainfall effects were observed; **after nearest overflow ceased operating.

Table 2—SS in Heywood Stormwater Sewage

Time of Sample	SS, ppm
First rushes	2,380
After 1 hr.	1,100
After 2 hrs.	690
After 3 hrs.	500
After 4 hrs.	380
After 5 hrs.	330
After 6 hrs.	280
After 7 hrs.	180

Table 3—Average SS During 10 Different Storms

545 ppm	1625 ppm
352	1329
434	557
515	296
2357	1077

single "solution" or even a group of solutions which will be applicable in all cases. While a specific solution may be feasible in one area, it may be unworkable in another. This would be true, for example, if the intended uses of the waters are markedly different or the relative volume of receiving water is significantly different. Each case must be judged on its own merits.

Stormwater Surface Runoff

High concentrations of suspended solids and elevated BOD in combined sewage are attributed largely to the stirring-up of sewer sediment when increased velocities occur during periods of rainfall. Stormwater surface runoff, we have been told, is largely rainwater (with small quantities of suspended solids and organic matter) which serves as a diluent in combined sewers.

Wilkinson (12) reports a study of surface runoff quality from a 1,000-acre modern, suburban, housing development at Oxhey, Hertfordshire, England. He notes, "In many recently developed housing estates (developments) the separate system of drainage has been used in which water from roofs and paved areas is collected in separate sewers and discharged direct to streams, without treatment. Among the advantages claimed for this system are considerable economics in size of foul (sanitary) sewers and in the provisions for dealing with storm water at sewage works. Discharge of partially treated storm sewage (combined flow) is avoided, but there have been misgivings about the possible pollution of streams by the first flushes of dirty water at the beginning of storms."

The quality of combined flow and surface runoff in Stockholm, Sweden, is reported by Akerlindh (13). The surface runoff study consisted of 132 samples taken from streets and parks during the summer of 1945-8. The author concludes, "The concentration of organic matter in the rainwater is comparatively great, and likely to correspond to a 5-day BOD of 100 to 200 ppm. In regard to bacterial (coliform) content, however, the rainwater portion of the stormwater (combined sewage) flow has in general a density of 10,000 to 100,000 coliform bacteria per 100 ml. On the average, this is of the order of 1/1000 of the density of sewage. Thus the rainwater flow actually has a diluting effect in this respect and its bacterial pollution can usually be disregarded in comparison to that of sewage."

Preliminary work by the New York City Department of Health indicates that surface runoff samples may contain as many as 160,000 coliforms per 100 ml., many of which *E. coli*, organisms specifically of the intestinal tract. The apparent sources of these organisms are the excreta of dogs, cats, birds, etc. Other work yielded coliform densities in the order of 3 to 400,000/100 ml (14).

Importance of Surface Runoff Quality

Stormwater runoff having a high BOD may have a significant effect upon the dissolved oxygen in streams. This factor frequently is not considered in American practice and may answer some of the hitherto obscure facets of dissolved oxygen deficiencies.

The influence of stormwater runoff upon the coliform picture in the receiving water presents practical problems. Assume a situation where combined sewers are present and the ratio of sewage to runoff is 1:10. Also, assume the average coliform density of dry weather sewage and runoff are 50,000,000/100 ml and 500,000/100 ml, respectively. The combined sewage will therefore contain approximately 5,000,000 coliforms/100 ml from the sewage and 500,000 coliforms/100 ml from the runoff for a total of 5,500,000. The runoff accounts for an insignificant increase in the coliform density of the combined sewage.

Where there are separate sewers, however, the situation presents greater problems particularly from the point of view of beach and shellfish water classification and administration. Separate storm sewers almost always discharge along the water's edge, into canals, etc. where little dilution is experienced for perhaps extended periods of time. However, if waters requiring low coliform densities are a considerable distance from the points of discharge, there may be no significant influence.

On the other hand, where the runoff water discharges at the bathing beach shore line or into a shell fish growing cove, the resulting coliform density may greatly exceed normally liberal standards. Are these waters safe for bathing or harvesting shellfish? Obviously a thorough knowledge of the sewage system, a sanitary survey, a search for unknown sewage discharges and a detailed knowledge of the storm water runoff quality are necessary before a reasonable conclusion can be reached.

A Search for Information

The exchange of correspondence with British workers has served to obtain the benefit of their experience. However, it is important for American engineers to ascertain conditions which prevail in this country so that we will be better equipped to come up with reasonable and effective solutions.

Accordingly, a questionnaire is being prepared by the New York City Department of Health and PUBLIC WORKS Magazine for submission to a number of American cities. This will be sent to most cities of 50,000 or more population which have combined sewer systems. The replies will be tabulated and published.

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ROCK SALT STABILIZATION WINTER-PROOFS ROADS

STANLEY S. SCARBOROUGH
Projects and Materials Engineer
Delaware State Highway Department

RECONSTRUCTION of unimproved roads with a minimum of expense and without creating a maintenance burden was a problem in Delaware, until we started seriously looking for an answer a few years ago. Our search was stimulated when the Delaware Legislature passed a legislative act charging us with responsibility for improving all of our 1,700 miles of unimproved roads within ten years. An initial sum of $10 million was appropriated for this purpose.

In considering the types of construction to try, we had to take into account the fact that many of our road-building materials are becoming critically scarce. So, besides limited funds, we had to find some way to use the materials already in place on our unimproved roads.

Adverse Conditions

In deciding to give rock salt stabilization a trial, we chose an area in New Castle County about ten miles north of our state capital of Dover. Conditions here are as adverse as any found in Delaware. The area is roughly only ten feet above sea level. It is flat and drainage is a severe problem. The four roads we chose to stabilize with rock salt were narrow and often impassable during all but freezing and very dry weather. Totalling 11.54 miles, these roads go through farmland, woods and swamps. If rock salt stabilization worked here, we felt it would work throughout the state.

Specifications called for 20-ft. roadways with ditch lines 30 ft. apart. The ditches were to be hydro-seeded with rye grass and oats and protected with a straw mulch and bituminous binder. A full width of 22 feet was to be rock salt stabilized to a depth of seven inches, then treated with 0.20 gal. per sq. yd. of MC-0 asphalt. This was to be followed with two applications of RC-3 standard bituminous seal coat with chips.

The contract was let to the Standard Bitulithic Company, Delaware Division, a branch of Warren Brothers of Cambridge, Massachusetts. Standard Bitulithic did all of the filling, grading, ditching, seeding and mulching. George B. Clarke & Sons was sub-contractor for stabilizing the roads. Because neither contractor had had any experience with rock salt stabilization, S. James Duncan, manager of highway technical service of the International Salt Company, directed the stabilization phase of construction.

Soil Conditions

Soil conditions on the newly-shaped, graded and filled roads varied dramatically. The original soil present on the roads had 72.5 percent passing a 200 mesh screen. Extensive sections of fill had 13.2 percent passing a 200 mesh screen. Highest density obtainable with the original material on the roads, which had a classification of A4, was 117.6 pounds per cubic foot at 10.6 percent moisture. Highest density obtained with the fill, classified as A1F, was 125.7 pounds per cubic foot at 9.4 percent moisture content. Upon making density analyses of the stabilized roadway after it had cured, we found an upgrading of the soil densities ranging from four to eight percent.

Construction

The contractor equipment used to stabilize the four roads included the following: two Seaman Pulvimixers; two Caterpillar patrol graders; one straight - wheel, pneumatic - tired roller; (William Bros Boiler & Mfg. Co., Minneapolis, Minn.); one 5 to 7-ton Huber-Warco steel wheel roller; one 10-ft chip spreader; three 1200 gallon water trucks; and four 5-yd. dump trucks.

Rock salt spreading: Our first step in stabilizing the roadways was to spread evenly 5.5 pounds of rock salt per square yard. This approximated 34 tons per mile of roadway. The rock salt, shipped from International Salt's Retsof Mine in New York State, met the A.S.T.M. D-632-43 contract specifications.

The four dump trucks picked up the rock salt from a nearby overhead railroad siding from covered hopper-bottom cars each holding 50 tons. The ten-foot-wide chip spreader, drawn behind the dump trucks, produced a uniform spread over the roadway.

Scarification: The patrol graders scarified the entire roadway to a depth of seven inches. Not only did this loosen the soil, but it also accomplished partial mixing of the rock salt with the soil.

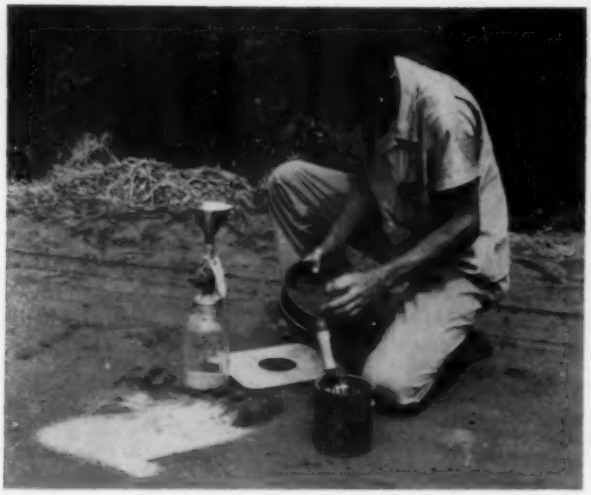
Mechanical mixing: The mechanical mixers made their first pass over the scarified roadway with tailgates up so that the large stones were left on the surface and could be picked up easily and tossed aside by men following behind the mixers.

First watering: Normal procedure called for the addition of water at this point. Because of a great amount of rain during construction we seldom had to add water. At this point, however, when rain had not already provided sufficient moisture content, the water trucks wetted down the mix to bring it within an approximate range of from three to six percent moisture content. We have found that the exact amount of moisture in the mix was not important so long as the rock salt went into solution and the mix was wet enough to be easily workable.

Mechanical mixing: The mechanical mixers, tailgates down this time, were then put on the roadway to blend the mix to a loose depth of seven inches.

Second watering: Although we found that the rock salt did a good job of holding the moisture, one road needed additional water at this point. It was the one day that was bright and dry.

Pneumatic rolling: The pneumatic roller was put to work making as many passes as necessary to compact the roadway. The roller was originally loaded with crushed stone to weigh about nine tons. Later, when working with a wet mix fol-



● SOIL conditions varied dramatically and frequent analyses were made by soils engineer of State Highway Department.

● AFTER roadway has been graded and leveled, the required amount of rock salt was laid on the surface by a chip spreader.

● MOTOR graders were used to scarify the roadbed to about a 7-inch depth following application of the salt. This process loosened the soil and helped mix the salt into the road.

● FOR thorough mixing of the salt into the soil, mechanical mixers were used. In first pass, stones are thrown to surface for hand removal. Second pass provided a smooth surface.

● PNEUMATIC rollers were used for the first stage of compaction to insure consolidation for the entire depth of 7 ins.

● FOR the final rolling, following the pneumatic compactor, a steel-wheel roller of five to seven-ton capacity was used.

lowing severe rainstorms, we lightened the roller by about two tons to keep it from bogging down. Not only did we find that this improved the results on the wet mix, but it also did a better job for us on the mix with normal water content.

Blading: We found that the original shape of the roadway was not appreciably changed by scarification and mechanical mixing. A light blading, therefore, was all that was needed after pneumatic rolling. This smoothed out the small variations in the roadway surface and established a five-inch crown.

Steel-wheel rolling: The steel-wheel roller was put to work to top dress and close the surface. We found the more rolling the stabilized roadways got, the sooner they seemed to set up. We, therefore, kept the steel wheel roller on each section of road until it was needed at another section.

Completion: As weather permitted, the stabilized sections dried out and set. We were concerned that several sections which had a high moisture content when they were stabilized would not cure along with the rest. These sections were shaded by deep woods on each side. They were slow to dry out because there was so much water in them, but generally they cured shortly after the more open sections of roadway.

As soon as the roads had achieved their set, the applications of MC-0 asphalt were made without additional surface preparation. Although specifications called for 0.20 gal., the stabilized roadway would take only 0.10 gal. per square yard. From three to seven days after applying the MC-0, the seal coats and chips were spread.

Latitude Allowable

Rock salt stabilization allows considerable latitude in construction practices and in materials. The fineness modulous of the soils to be stabilized is not very critical. As mentioned earlier, on this 11.54-mile project, original and fill soils, both of which made up the final stabilized course, ranged from 72.5 percent down to 13.2 percent passing a 200-mesh screen. Even with these extremes in soils, the state inspector and our soils man found that the entire section of roadway could be treated the same.

Moisture content of the soils to be stabilized also allows a good deal of leeway. One section of our project had had rock salt spread and had been scarified when construction was interrupted by a steady downpour. After a little drying out the next morning to permit the mechanical mixers to get in, construction was able to progress. At one point in the project, 4.46 inches of rain came down within a twelve hour period. Half a day after the rain stopped, the crews were back at work.

In constructing rock salt roadways, the one step that allows no time delay is the final blading. This dressing must be done immediately after or during pneumatic rolling before the mix has taken its final set.

Our rock salt stabilized roads resisted water damage effectively. The only apparent damage to the roads has been caused by farm and snow-plowing equipment which have cut through the surface seal. Where this has happened, we have had to patch. In several holes that we observed this past summer, typically only a few inches in diameter, the rock salt stabilized base had been washed away to a depth of as much as an inch but recrystallized salt was evident in each hole and the base was firm to the edges of the breaks.

The cost of stabilizing our 11.54 miles of roadway was $1,468 per mile for processing, plus the cost of rock salt. □□□

● **AT DEMONSTRATION** of the electronic traffic controller, Robert J. Sloan, President of Crouse-Hinds Co., shows an application of the unit by use of a model.

Traffic Controller Avoids the "Wasted" Green Light

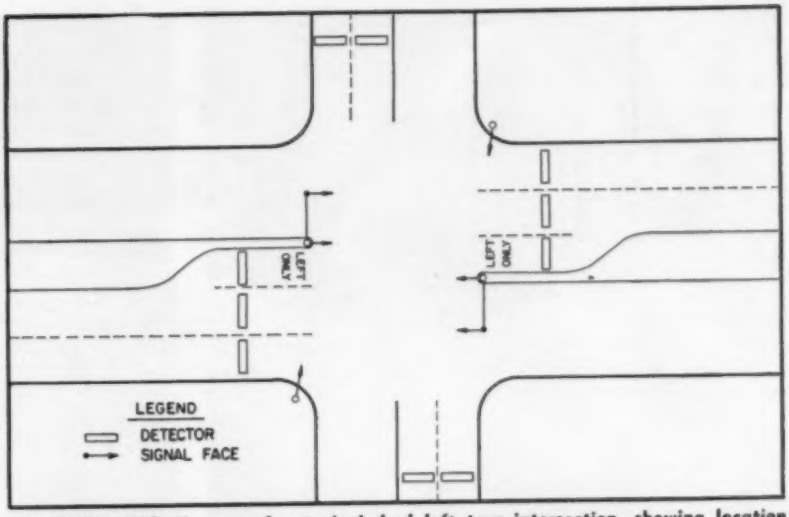
A TRAFFIC signal controller that automatically adjusts signals to function in accordance with the traffic load at complicated intersections has been developed by Crouse-Hinds Co. Designated as the ETC-909, the instrument has primary application at an intersection of a major multi-lane artery with left turn slots in each direction and a cross street. It is fully actuated by the traffic load, with each phase functioning only as the load demands, and is said to be designed on a new concept in traffic control—immediate response to the need. This feature is achieved by employing electronic circuits that permit skipping phases of signal change where no load exists, thereby avoiding delays encountered by the various signals at an intersection completing a predetermined

time cycle in rotation. It is basically a five-phase controller, the phases being 1) movement of traffic in either direction on the cross street, 2) movement to the right and in one direction straight ahead on the major street, 3) movement to the right and in the opposing direction on the major street, 4) left turn from one approach of the major street and 5) left turn from the other approach of the major street. The flexibility of the controller, however, permits four variations of these parent phases so that non-conflicting traffic movements may proceed simultaneously.

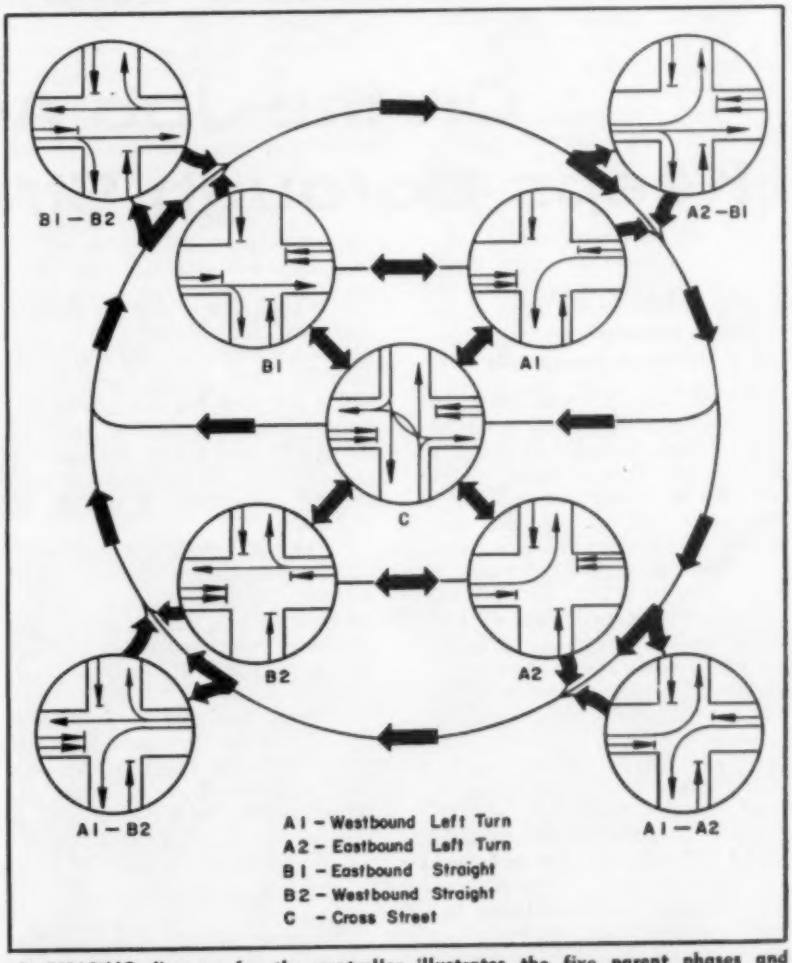
By actuating a detector embedded in the traffic lane or suspended, an approaching vehicle will cause the controller to change the signal to allow passage in the desired direction. The signal then remains unchanged until a vehicle approaches the intersection in a lane indicating movement in a direction conflicting with the previously established traffic flow pattern. After this vehicle passes and the lane is cleared, the controller returns the signal to the original condition to allow the interrupted traffic flow to continue. When there is no traffic, the signals remain as actuated by the last vehicle.

The controller is equipped with timers for each signal phase and these are adjustable so that the intervals of interruption of traffic flow can be preset for the peculiarities of each intersection. Each signal phase has four timed intervals. The adjustable range on the initial interval is 5 to 30 seconds, 2 to 14 seconds on an extension, 10 to 90 seconds on the maximum and 2 to 8 seconds on the yellow clearance. One vehicle call actuating the detector results in a timing of the initial and one extension interval. Each successive actuation during the extension interval cancels the unexpired time of the preceding actuation and starts another unit extension. This continues until a call is received on a conflicting phase. The controller then imposes the maximum interval to allow the conflicting movement. A memory feature in the circuitry returns the right-of-way assignment to the phase having the high traffic load after the conflicting call is answered.

The controller responds to any type of actuating sensor and may be used with existing signals. Its modular construction using simplified plug-in connections, allows the individual components of the wiring and timing mechanisms to be removed for servicing. □□□



● **SCHEMATIC diagram of a typical dual left turn intersection, showing location of signal faces and vehicle detectors required for operation of traffic controller.**



● **PHASING diagram for the controller illustrates the five parent phases and the nine possible traffic movements. Elimination of the time-sequence restrictions on the parent phases makes possible transfer of right-of-way from any traffic movement phase to any other phase, according to demand. For example, if movement A2 is in effect, and a call is received from A1, the controller changes to condition A1-A2. If the demand on A1 ends and a call is received on B1, signal changes will allow movement A2-B1. In the absence of traffic the right of way remains on the approach having the last vehicle call, which could be any of the nine movements.**

● SNOW is removed from the business sections using two dump trucks and a tractor with front-end loader attachment.

● ONE-WAY plow in use. Plowing continues until streets are open from curb to curb. A V-plow is used on alley work.

On-the-Job Action Keeps Borough Streets Open

FRANK FORCE

Manager-Engineer,

Hellertown, Pennsylvania

SNOWFALL MEASURED approximately 61 inches in the Lehigh Valley and the Borough of Hellertown, Pennsylvania, during the 1960-61 winter season. Most of this snow fell during the three major snowstorms that occurred on December 11, 1960, January 19, and February 3, 1961.

Borough forces prepare their snow fighting equipment in August for the coming winter. Hellertown has one Good-Roads one-way plow, one Loder two-way plow and one Good-Roads V-plow. The two-way plow is used on an International R170 truck and the one-way plow is used on a GMC 370 truck. The V-plow is attached to a Galion Model 303 motor grader. Bids were solicited this year for a new reversible plow. Glidden Silicone Driwal is used as a wax on the surface of the plows. A Good-Roads spinning-type spreader is attached to a ¾-ton Ford truck to spread ashes and calcium chloride. An IHC 300 tractor with a bucket loader attachment is used to load snow.

Chains are a very important item in keeping snow plowing equipment in the field. The chains are checked carefully for broken links and cross-ties. There are two sets available for each of the dump trucks and a set each for the grader and tractor. The Mars flashing lights on the trucks and grader are checked and repaired. In late October permanent anti-freeze is put in all radiators.

Ashes and cinders mixed with calcium chloride are used to control driving conditions on snow and ice-covered streets. The cinders are purchased from the Bethlehem Steel Co. ot $2.50 per dump truck load. An 80-lb. sack of Solvay calcium chloride is used per truck load of cinders. Main intersections and steep slopes on main streets are the first to be cindered. There are approximately 19 miles of streets and 9 miles of alleys to be maintained by the Borough.

Snow Plowing

The main streets and the bus routes are the first streets to be plowed when the snow reaches a depth of four to five inches. Plowing will start sooner if there are winds greater than 15-20 mph. Plowing continues until two passes have been made on all streets. Two more passes are made on all streets as soon as possible after they have been initially opened. It is our policy to open all streets face-to-face of curbs if possible. Of course, cars parked along the curbs do cause a lot of trouble. Each truck is manned by a driver and a helper when they are plowing snow.

The V-plow attached to the grader is used to open alleys. A leys are opened during the night so that the garbage truck can use the alleys the next day for refuse and garbage pick-up. An advantage of the V-plow is that an equal amount of snow is pushed on each side of an alley. Only one pass is taken down each alley.

In snow removal from the business area, snow is removed from in front of schools, funeral homes, drugstores and doctors' offices first. Next come bus stops, restaurants, food markets and churches. Used in snow removal are the two dump trucks and the IHC 300 tractor with the front end loader attachment. The crew of men consists of the tractor operator, two truck drivers and a laborer who shovels the snow from the sidewalk to the gutter.

Clarence Trauger is in charge of the four-man street crew. Harry Gregory is the Chairman of the Street Committee. □ □ □

Safety Rest Areas On Wisconsin's Interstate System

C. E. ATEN
Engineer of Maintenance
State Highway Commission of Wisconsin

AS MORE AND MORE sections of the National System of Interstate and Defense Highways are completed and opened to travel, demands by the traveling public for suitable rest areas on the system increase in proportion to the longer distances available for uninterrupted travel. To meet that demand a large number of states, including Wisconsin, have developed safety rest areas or are planning such development in conjunction with the construction of the Interstate highways.

At the present time, Wisconsin has in operation four rest areas on a 55-mile segment of Interstate Highway 94 in the northwestern sector of the state between Eau Claire and Hudson. Grading and surfacing of the acceleration and deceleration lanes and parking areas were started in the fall of 1958 and completed in the early summer of 1959 at an approximate cost of $60,000 for each rest area. In July of 1959 our Highway Commission let to contract the construction of four rest area buildings and related facilities at a cost of approximately $25,000 per building. All four rest areas were opened to public use during July of 1960.

Included in the July, 1959, contract were the construction and complete outfitting of four comfort station buildings, each 12′ x 25′ in size; drilling a well at each of the four locations; making arrangements for bringing in power and telephone service; constructing sewage disposal systems; and providing indoor and outdoor lighting, sidewalks, and miscellaneous construction items to permit use of the comfort buildings immediately upon completion of the contract.

These rest area buildings have poured-concrete foundations and concrete block walls with lannon stone facing and are completely equipped for summer and winter operation. A thermostatically-controlled, gas-fired, hot-air furnace maintains a minimum temperature of 45 degrees in each of the two toilet rooms and fresh air ventilators and exhaust facilities are provided for proper air circulation. A complete pressure-type water system, including outside drinking fountain, interior lavatory facilities, flush-type toilets, and waste disposal system, is provided. An electrical system for both interior and exterior lighting of the building and parking area is also included. Concrete floors in the toilet rooms have a quarry tile surface and interior walls are coated with a hard-glaze finish for ease of maintenance. A public telephone booth is provided at the front of the building and a utility room at the rear for storage of supplies and equipment.

The well which provides the water supply at each rest area must have a minimum capacity of seven gallons per minute, and the operation of pumping equipment is automatically controlled by an 82-gallon pressure-supply tank located in the utility room. At the present time, the outside drinking fountain must be drained and made inoperative because of freezing conditions in the winter. However, we are presently considering the possibility of installing a freeze-proof type of fountain to permit the availability of a drinking water supply all year around.

The sewage disposal system is designed independently for each rest area with the type of system predicated on recommendations by the State Board of Health and local conditions and soil types which would have an influence on the type of disposal system to be utilized. In general, the use of a septic tank and dosing chamber along with a tile dispersion field has been found most feasible in the majority of our Interstate rest areas.

Electrical power for operation of the building facilities is derived from a service line brought in to each area from the nearest main transmission line of a power utility. We were fortunate in that such utilities were readily available at each of the four completed rest areas and no extensive service line construction was necessary. Telephones were installed by local telephone companies, in three cases subject to Commission agreement to pay the normal monthly service charges.

A sidewalk provides all-weather access from the parking area to a concrete porch which extends across the front of the building and along both ends. The parking areas and the rest areas are designed for segregated parking of approximately 25 to 30 cars and 15 to 20 trucks. A few picnic tables and waste receptacles are the only other facilities provided to date in our safety rest areas.

● **COMFORT station at rest areas. Toilet facilities are at ends, telephone in center.**

Operating Experience

We have now had somewhat over one year's experience in operating and maintaining our rather elaborate rest area facilities and during that time we have encountered a few things which might be worthy of mention in this article. First of all, shortly after the rest areas were opened to the public we became curious as to the extent and nature of usage of these areas. We therefore initiated a traffic count at the entrance ramp and a manual count of vehicles and passengers actually entering the rest areas. In general, our brief studies disclosed that approximately 10 percent of the total single-direction traffic on the through lanes (which at the time of the study amounted to approximately 2,700 vehicles per day on each of the divided roadways) stopped at the rest areas for one purpose or another and that each vehicle carried an average of three passengers. Of the total number of passengers entering each area, approximately 50 percent used the toilet facilities, 25 to 30 percent merely rested momentarily before traveling on, 10 to 15 percent used the picnic facilities, and only 2 percent used the public telephone. On the basis of this initial information plus that derived from additional use studies currently underway, we would expect that when traffic increases to the 1975 design volume of approximately 10,000 vehicles per day on this section of highway, each of the four rest areas will probably be serving somewhat over 1,000 vehicles during any 24-hour period.

Our experience to date would indicate that vandalism may not be too serious a problem. The only significant vandalism encountered to date has been the ripping out of two telephones and minor damage to waste paper receptacles provided in the toilet rooms. We would believe that perhaps the lighting of the buildings and parking area, and the fact that the State Traffic Patrol maintains 24-hour surveillance on this section of Interstate highway have been significant factors in minimizing the type of malicious destruction which has been evident in other wayside areas on Wisconsin's trunk highway system.

At the present time we have one man who is responsible for maintenance of two rest areas during normal working hours from Monday through Saturday and as necessary on Sunday. This man would be the first to acknowledge that he has a full-time job. Although we feel that the degree of care-taking provided in the first four rest areas is adequate at the present time, we believe that completion of future extensions of the Interstate highway with attendant traffic increases will require that a full-time day caretaker be assigned to the maintenance of each rest area, with some additional help for periodic checks at night.

Maintenance Problems

Problems encountered in maintaining the rest area buildings have been surprisingly minor to date, particularly in view of the fact that the buildings and all their facilities were designed by highway design personnel who are not experts in the field of building and architectural design. We encountered a few difficulties in operation of the furnace system last winter due to minor design and construction faults, but we believe that we now have the problems solved and future winter operation can be conducted smoothly. Winter maintenance of the parking areas and acceleration and deceleration lanes is not expected to constitute much of a problem and we anticipate that plowing and ice control operations can be timed with the operations conducted on the through roadways. Any breakdown of the furnace system can be easily detected by the State Patrol through the use of a red warning light on top of the building which flashes on when the temperature in the toilet room drops below the specified minimum. We also have special services agreements in effect with local contractors for emergency repair of either the heating, plumbing, or electrical systems. With such advance preparation we expect to be able to accomplish any emergency repair or restoration before any damage occurs to the building's facilities.

Our maintenance costs experienced to date could hardly be considered as representative since our first year was primarily a trial-and-error period. However, on the basis of the costs incurred to date, we would expect an average annual expenditure of between $6,000 and $8,000 for maintaining each area on our Interstate System. This would include the cost of mowing and clean-up of the rest area grounds, telephone and electrical energy charges, and all costs in the operation, supplying, and maintenance of the comfort building. Should the assignment of an individual caretaker per area become necessary—as we believe it will—the estimated cost will probably approach $10,000.

Wisconsin is continuing to plan and develop additional rest areas on the same basic pattern of the first four, with some minor changes in design which we in the Maintenance Section have recommended as being desirable and necessary from the standpoint of facilitating our maintenance operation. Upon completion of Wisconsin's 450-odd miles of Interstate Highway, we expect to have a total of 18 rest areas in operation. These areas will be located in pairs, staggered in such a manner that the right-hand area is seen first by oncoming traffic. We are confident that the high cost of developing and maintaining our rather elaborate facilities will be justified by a high degree of public use as the completion of our Interstate System comes closer and closer to reality □ □

Table 1—Rest Area Use Study

	1	2	3	4	Total
Cars, Wisconsin	49	57	42	36	184
Passengers	122	132	103	81	438
Persons per car	2.5	2.3	2.5	2.3	2.4
Cars, Out-of-State	75	91	77	57	300
Passengers	216	253	218	152	839
Persons per car	2.9	2.8	2.8	2.7	2.8
Total Cars	124	148	119	93	484
Total Passengers	338	385	321	233	1277
Persons per car	2.7	2.6	2.7	2.5	2.6
Trucks	49	68	51	37	205
Total Vehicles	173	216	170	130	689

Notes: Area 1 is on east bound I-94 in St. Croix County
Area 2 is on west bound I-94 in St. Croix County
Area 3 is on east bound I-94 in Dunn County
Area 4 is on west bound I-94 in Dunn County

Lining an Old Sewer With PLASTIC PIPE

R. J. KENT

Superintendent of Sewers, Greenwich, Connecticut

THE SEWER DIVISION of the Town of Greenwich, Conn., recently lined an old 15-inch sanitary sewer with a 12-inch plastic pipe to correct a serious infiltration problem. Greenwich is a shorefront community and some sewers are below sea level. One 210-foot section has been a problem for many years due to salt water infiltration. The salt water entering the system was thought to retard sludge digestion at the treatment plant and to add to the unpleasant hydrogen sulphide odors often noticed there. The additional water also added to the pumping costs. The tile pipe had been encased in concrete when it was laid in 1930, but the concrete has deteriorated badly and only loose aggregate remains around the pipe.

A series of pictures of the inside of the old pipe, taken in 1959 by the Underground Photographic Surveys, Inc., of Randolph, Mass., indicated that leakage occurred at almost every joint. The photographs also showed that the pipe was structurally sound and that no serious lateral displacements had taken place. A number of possible solutions for correcting the condition were considered and rejected as either too costly or lacking a reasonable chance of success.

● **THIS picture shows 12-in. plastic pipe used for lining, with guide. UPPER right picture shows making up the joint by prying with crowbar. Shiny spot at far end of pipe was caused by the solvent.**

In the spring of this year we were told that the Hartford, Conn., Metropolitan District had used plastic pipe to line an old brick sewer. After talking with the men responsible for this work we decided to apply their solution to our problem. We learned that we were fortunate in having no house connections in this section of pipe, as digging up and reconnecting house connections had added substantially to the cost and difficulty of the Hartford work.

The pipe we used was Evanite plastic pipe made by the Evans Pipe Co. of Uhrichsville, Ohio. The 12-inch inside diameter pipe we purchased had a wall thickness of slightly over ¼ inch, and was supplied in 10-foot lengths. Sections were coupled together by a simple sleeve coupling 11½ inches long with an outside diameter of 13 9/16 inches. These dimensions left an annular clearance of about ¾ inch inside the old pipe.

A 20-ft. section of the old pipe was excavated and the upper half of the pipe was carefully broken out. This enabled us to maintain the sewage flow in the pipe and the water seemed to provide lubrication when the plastic pipe was pulled through the old pipe. A wire cable was passed through the old pipe and a bucket type sewer cleaning power winch was set over the downstream manhole to pull the cable. The front end of the first section of plastic pipe was fitted with a home-made metal guide to aline the pipe properly and to prevent the open end catching on a projecting joint.

The pipe sections were joined, in the ditch, by coating the inside of the coupling and the end of the next pipe with solvent and simply pushing the pipe inside the coupling. As each length of pipe was added the wire cable was passed through the next length. A 2"x4"x13" wooden block on the end of the cable was placed against the end of the plastic pipe when pulling that section through. The plastic pipe was placed to project slightly into both manholes and the openings were carefully caulked to make a watertight seal. The insertion of the plastic pipe in the old pipe was accomplished without difficulty in about three hours by a crew of six men. With additional experience this time could be somewhat reduced.

Samples of sewage showed an increase of 1,100 mg/L of chlorides in this section of pipe before it was lined. Samples taken at high tide after lining the old pipe showed a negligible increase in chlorides, indicating that we have practically eliminated salt water infiltration in this section. The reduction in internal diameter in this short section of sewer is not serious at this location and the benefits obtained from the elimination of infiltration outweigh this slight disadvantage. We expect to check this section periodically for infiltration and to observe any effects the sewage may have on the plastic pipe.

The assistance of Philip Barone of Providence, R. I., during the work is gratefully acknowledged.

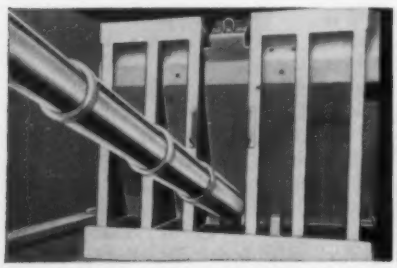
Hydro E-Z Packs help win 3 new municipal contracts

ADAM SCHLEINING, President, Santa Ana Commercial Co., Inc.

"We're saving at least $13,760 monthly with 32 Hydro E-Z Packs"—

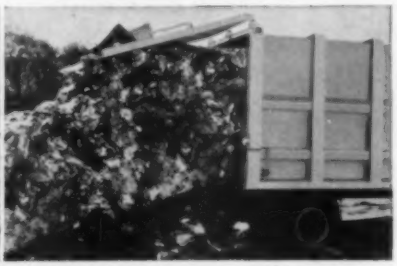
In Santa Ana, Calif., Adam Schleining, President, Santa Ana Commercial Co., Inc., reports, "Our fleet of 32 Hydro E-Z Packs is saving us at least $13,760 monthly compared with the costs of operating open trucks. We are handling about 10% greater volume with half the number of trucks and men, even though our former equipment was self-packing." Mr. Schleining figures that E-Z Packs save two 40-minute dump trips daily per unit. And since one man with one E-Z Pack averages 375 pickups daily, efficiency is up 110% over trucks with 3-man crews.

"With this efficiency, we have won 3 new municipal contracts in 2 years on low competitive bids," Mr. Schleining said. For the full story see your Hydro E-Z Pack distributor or write us for a free copy of "The Big Squeeze."



76,600 lb. maximum pressure is applied by telescopic cylinder. E-Z Pack is world's most powerful refuse compactor.

One-piece door with strong box section framing absorbs compaction force, keeps its shape. Body stays watertight.



No hoisting! No chains or weights needed to hold down front end. The same blade that compacts refuse discharges fully packed load.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Top Ten Public Works Men-of-the-Year Honored by APWA

For the second consecutive year, the American Public Works Association's panel of judges has marked ten outstanding officials as representatives of the high caliber of public servants within the ranks of the public works profession.

Chosen to receive awards as one of the "Top Ten Public Works Men-Of-The Year" were: David V. Auld, director of sanitary engineering, government of the District of Columbia; Henry A. Barnes, commissioner of transit and traffic, Baltimore, Maryland; Hugh A. Benner, director of public works, Saginaw, Michigan; William A. Bugge, director of highways, State of Washington; George De Ment, commissioner, department of public works, Chicago, Illinois; Robert H. Hess, director of water and sewage treatment, Wichita, Kansas; David B. Lee, director of the bureau of sanitary engineering, Florida State board of health, Jacksonville, Florida; Eugene Maier, director of public works and engineering, Houston, Texas; Jean L. Vincenz, director, department of public works, San Diego County, California and Brig. Gen. Alvin C. Welling, commanding general, corps of engineers ballistic missile construction office, Los Angeles, California.

Announcement of those receiving the award this year was made at a special luncheon held on Tuesday, September 26, in Minneapolis, during the American Public Works Association's 67th annual congress and equipment show. The luncheon also served as the opening gun for this year's national public works week observance, October 1-7, sponsored jointly by the APWA and Kiwanis International. Selection of the "top ten" is an integral part of the observance, which is designed to both create a greater citizen's awareness of the importance of public works and to recognize public works officials who are typical of the outstanding men serving in this field.

The selections were made at an August 24 meeting in Washington, D.C. The official announcement was delayed to coincide with the congress luncheon and the NPWW observance. Serving as panelists of this year's judging committee were J. O. Tally, Jr., immediate past president of Kiwanis International, Fayetteville, North Carolina; Harmer David, director, Institute of Transportation and Traffic Engineering, University of California, Richmond, California; William Foster, editor, American City Magazine; Mark Hollis, chief engineer, U.S. Public Health Service, Washington, D.C., and Ray Lawrence, consulting engineer, Black and Veatch, Kansas City, Missouri and president of the Water Pollution Control Federation.

The panelists, upon completion of the admittedly difficult task of selecting ten individuals from among the outstanding nominees for the awards, cited the following considerations which directly influenced selection of this year's award winners:

David V. Auld: A graduate of Princeton University (B.S., Civil Engineering), Auld was named director of the department of sanitation for the Government of the District of Columbia in 1953. His distinction in the management and direction of the water and sewage facilities, his work on the National Planning Commission and leadership for promoting water pollution abatement, and extensive professional activities were cited by the panel.

Henry A. Barnes: Formal education received at the General Motors Institute, Flint, Michigan with supplementary courses from the University of Michigan, Michigan State University and Yale University. Barnes joined the City of Baltimore in 1953, and was named commissioner of transit and traffic in 1957. The judging panel noted his leader-

OFFICERS: Albert G. Wyler, New Orleans, La., *President;* Edward Booth, Bismarck, *Vice President.* REGIONAL DIRECTORS: (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; (term ending 1963) George J. Maher, Lewiston, Maine: Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas; (term ending 1964) Lloyd D. Knapp, Milwaukee, Wisc.; John A. Lambie, Los Angeles County, Calif.; Roy W. Morse, Seattle, Wash. *Immediate Past President,* Frederick W. Crane, Buffalo, N. Y. Robert D. Bugher, *Executive Director.*

ship in the development of electronic traffic control measures in Baltimore and during a prior assignment in Denver, Colorado. Barnes was first to develop the traffic-free interval for pedestrian crossing at controlled intersections.

William A. Bugge: Attended Washington State University. Named to his present post as director of highways for the state of Washington in 1949, Bugge was honored for his internationally recognized accomplishments in the field of highway design and construction. Bugge is a past president of the American Association of State Highway Officials and chairman of the Highway Research Board of the National Academy of Sciences.

Hugh A. Benner: A graduate of the University of Michigan and registered professional engineer, Benner was named to his present post as director of public works, Saginaw, Michigan, in 1947. The judging panel noted Benner's accomplishments over a wide range of public works functions, and his capabilities in the fields of street lighting, snow removal and water supply, which is reflected in the awards received by the city of Saginaw for excellence in these fields.

George De Ment: A long-time city employee and graduate of the University of Illinois, De Ment was named Chicago's commissioner of public works in 1954. The panel cited De Ment for his ingenuity in meeting the demands of a rapidly growing community by applying engineering techniques that have influenced the planning of many communities. The combination of rail rapid transit and expressway traffic, and accomplishments in the city's airport and water filtration construction programs were noted by the judges.

Robert H. Hess: A 1936 graduate of the University of Kansas (M.S., Sanitary and Chemical Engineering) Hess was named director of sewage and water treatment for Wichita in 1955. His nationally recognized efforts on behalf of water pipeline research and ability in operating Wichita's highly complex water works were noted by the judging panel.

David B. Lee: A graduate of the University of Florida and of Harvard, Lee joined the Florida State Board of Health in 1932 and was named director of the bureau of sanitary engineering in 1941. His contributions as an advisor to the United States delegation to the World Health Organization, consultant to the Atomic Energy Commission on the problem of radioactive wastes, member of the President's commission on the health needs of the nation, and his wise counsel and advice to countless officials on water and sewage problems in Florida were cited as contributory factors in naming Lee as one of this year's top ten.

Eugene Maier: A University of Kansas graduate and research fellow at Yale university, Maier became a city employee in 1947, formerly served as its director of traffic and transportation, and was named director of public works and engineering for the city of Houston, Texas, in 1959. Maier received special recognition from the panel for ability and leadership in the field of traffic control. Maier is a member of the national joint committee on uniform traffic control devices and several Highway Research Board committees.

Jean L. Vincenz: A graduate of Stanford University and San Diego

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This low cost Flink Model HD42 is ideal for towns needing a combination ice control and seal coating machine.

This is why highway department officials continue to recommend Flink spreaders. They've learned, from experience, that Flink spreaders can move out and clear up icy highways fast. What's more, certain models double in seal coating and dust control in the summer.

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Take the Flink Model HD42 for example. This hydraulically powered tailgate spreader is used for ice control, seal coating and dust control in hundreds of towns, townships, cities and counties. Patented oblique blades lay a mat spread of even thickness. Controlled from cab. Truck can dump same as with original tailgate.

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With the Flink Model HDWS4, considerable material is saved because the left-side spinner directs material onto

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roadway, not the shoulder. A fleet of these hydraulically powered, cab controlled spreaders are keeping traffic rolling on the Illinois Tollway right now. Two-speed auger conserves material, permits instant change from abrasives to straight rock salt.

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In addition to a full line of tailgate spreaders, Flink makes hoppers ranging in capacity from 4 to 13 cubic yards. Model LMC, shown above, is available with PTO, hydraulic or gasoline engine drive, cab controlled. Some have mechanically operated two-speed conveyors with quick change from high to low. Others have individually controlled conveyor and spinner disc, hydraulically powered.

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State college, Vincenz was city engineer of Fresno, California and was named director of public works for San Diego County in 1947. His work in organizing and directing one of the first county public works departments in this country and his pioneering work in the development of the sanitary landfill method of waste disposal were cited by the panel of judges. Vincenz is a past president of the American Public Works Association and of the League of California cities.

Brig. Gen. Alvin C. Welling: A graduate of the United States Military Academy, Gen. Welling is head of the ballistic missile construction office of the U. S. Army Corps of engineers in Los Angeles. The panel noted General Welling's contributions to national defense in effectively overseeing and efficiently managing the construction of 70 ICBM launching sites.

These ten men will receive engraved plaques naming them as one of the "Top Ten Public Works Men-of-the-Year" at special ceremonies in their home town during National Public Works Week.

Wyler New APWA President

Albert G. Wyler, director of streets, New Orleans, Louisiana, has been chosen to succeed Frederick W. Crane as president of the American Public Works Association.

After tabulation of the mail ballot returns, Wyler, a veteran of more than 35 years' service with the city of New Orleans and an APWA member since 1937, was chosen to succeed Crane, who is general manager of the Buffalo, New York sewer authority. Serving with Wyler for the 1961-62 term will be APWA Vice President Edward J. Booth, city engineer of Bismarck, North Dakota and an Association member since 1946. Wyler has served on the APWA board of directors since 1952 and Booth was named to the same board in 1957.

Wyler, who holds a degree in civil engineering from Tulane university, is a past president of the Association's New Orleans chapter. Booth was instrumental in the founding of APWA's North Dakota chapter.

New members of the American Public Works Association's board of directors are Lloyd D. Knapp, commissioner of public works, Milwaukee, Wisc., succeeding Louis H. Moehr, city engineer, Wyandotte, Michigan, and John Lambie, county engineer, Los Angeles, California,

An engineer of Quebec's Hydro-Electric Commission examines the Bitumastic coatings inside the huge Bersimus penstocks.

Bitumastic lining stands up like new in high pressure penstock service

The most critical points in the giant Bersimus River penstocks are the eight 328-foot steel pipe sections, located immediately below the elbows, where water pressure reaches 540 pounds per sq inch. Quebec Hydro-Electric Commission engineers picked Bitumastic coal-tar enamel for the protection of the steel pipe in this tough service.

The coatings applied to this section had to meet very stringent requirements: first, the high moisture content inside the penstocks made it necessary to use a very fast drying primer to protect the coating's bonding action from moisture attack. This requirement was fully met by Bitumastic Jet-Set Primer, the fast-drying primer with a bond estimated to be five times stronger than other primers.

Two coatings of Bitumastic No. 70-B AWWA Enamel were applied to meet the other requirement: these top coatings will have to provide a minimum of five years maintenance free service. A recent over-all inspection of the line indicated that the coatings are still in excellent condition and should last 40 years or more, based on previous experience.

Koppers coal-tar protective coatings are ideally suited for severe corrosion conditions where water resistance and maintenance free service are mandatory. For more information on how Bitumastic coatings can solve your corrosion problems, mail the coupon or write: Koppers Company, Inc., Pittsburgh 19, Pa. District Offices: Chicago, Los Angeles, Pittsburgh, New York and Woodward, Ala. In Canada: Koppers Products Ltd., Toronto, Ontario.

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succeeding John A. Morin, assistant city manager, Oakland, California. Roy W. Morse, city engineer, Seattle, Washington was re-elected to serve a three year term on the board.

Fagerlind Honored by APWA

Carl C. Fagerlind, street commissioner, Waterloo, Iowa has received the 1961 Harry S. Swearingen award of the American Public Works Association in recognition of his outstanding services to the Association and its local chapter.

Mr. Fagerlind

The award, established to honor the memory of Harry S. Swearingen, was presented to Fagerlind in recognition of his valuable efforts in promoting the aims and objectives of the Association in the State of Iowa.

Fagerlind was instrumental in the founding of the Association's Iowa chapter and was first president of that chapter. He has been an APWA member since 1951. Fagerlind received the award medal at the annual banquet of the American Public Works Association Congress and Equipment Show held on September 27 in Minneapolis.

Palumbo Wins Aid-to-Education Award

Frank P. Palumbo, Jr., engineer in charge of surveys for the city of Memphis, Tennessee, has been chosen as winner of the American City magazine's $1,000 aid-to-education award. The grant is applied to the recipient's future schooling at the rate of $40 per semester hour.

Mr. Palumbo

Administered by the American Public Works Association, the award is intended to provide financial assistance to deserving students and municipal employees who have completed three years of study at an accredited engineering school and who wish to continue their education in preparation for careers in the public works field. The award also provides for an all expense paid trip to the Minneapolis Public Works Congress and Equipment Show, September 24-27, where the presentation ceremonies took place.

Palumbo, 31, was born in Brooklyn, New York, and has completed the equivalent of 3½ years of college credit courses toward a degree in engineering at Arkansas State College and the University of Tennessee.

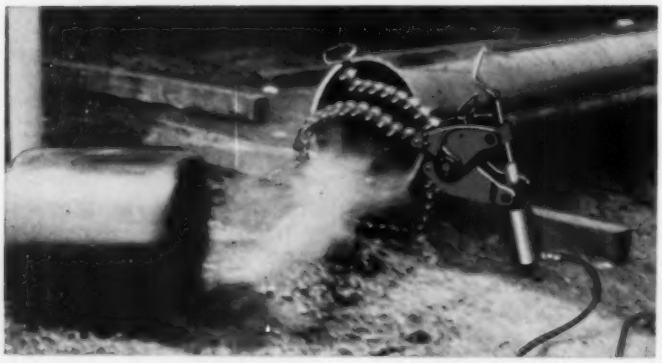
A committee composed of Arthur Bird, city engineer, Cincinnati, Ohio, E. L. Filby, Black and Veatch, consulting engineers, Kansas City, Missouri; and Fred Glendening, director of public works, Phoenix, Arizona, chose Palumbo from among many candidates. The outstanding recommendations from city officials and the quality of the technical paper he submitted, entitled "Assignment Overpass," were the major factors in Palumbo's selection.

• • •

Content of Berlin Refuse

In Berlin, Germany, an analysis of refuse showed it contained 45.43 percent ashes; 7.63 percent of paper; 1.24 percent rags; 2.16 percent iron; 0.16 percent leather; and 1.56 percent bones. Kitchen waste amounted to about 30 percent of the total.

A WHEELER HYDRAULIC PIPE CUTTER



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*sizes over 12″ require optional extra chain

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Owners of the "Euc" C-6 report that it's the best balanced tractor in the 200 h.p. class. Low center of gravity and close mounting of blades made possible by a rear-mounted radiator eliminate "nosing down" in heavy dozing work. The C-6 works easily on slopes where other crawlers can't be used because they won't hold on . . . and lower ground pressures let the "Euc" work in soft going that stops competitive tractors.

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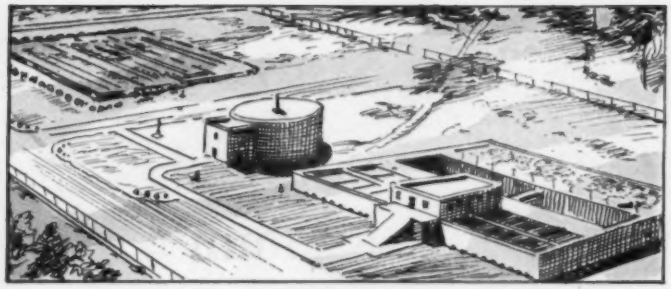


Prepared by **ALVIN R. JACOBSON, Ph.D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Trickling Filters

Of particular concern to sanitary engineers in combating water pollution is the necessity of developing new methods of waste treatment and evaluating parameters of loading and criteria of performance of existing methods. To obtain a more fundamental understanding of physical and biological mechanisms of waste treatment and the problems related to their application a long term trickling filter research program was begun in 1957. The following specific objectives were of immediate concern in this project: 1) To determine operational characteristics of a deep trickling filter over a wide range of loadings in order to determine the applicability of design standards; 2) to evaluate the reliability of measurement indexes for testing treatment efficiency and loading, with particular emphasis on the relation of water-soluble carbon and BOD. Test facilities necessary for carrying out specific objectives of this research were constructed at the Corvallis, Ore., sewage treatment plant. Test procedures included analyses for 5 and 20-day BOD, dissolved oxygen, ammonia, nitrite and nitrate-nitrogen, pH, temperature, and water-soluble carbon. From this study it has been concluded that: 1) Water-soluble carbon as measured by the persulfate oxidation test is a good measure of organic pollution in water and may be correlated to the 5-day BOD; 2) information gathered on 5-day BOD reduction and nitrification within the experimental filter substantiates Velz's basic law as expanded by Gratham et al.; 3) high hydraulic and organic loadings with the weak sewages examined yielded results far lower than results predicted by theoretical formulas; 4) oxidation rates with filter depth indicate that test facilities to be constructed with controlled media size and environment need not exceed 8 to 10 ft.

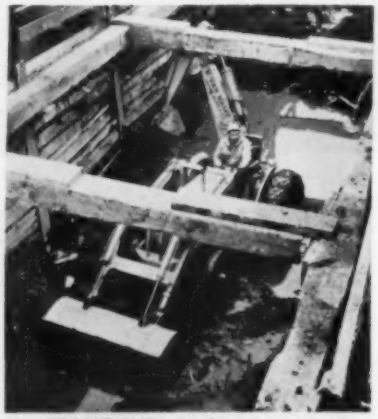
"Evaluation Criteria for Deep Trickling Filters." By F. J. Burgess, C. M. Gilmour, F. Merryfield, and J. K. Carswell are, respectively, Associate Prof. of Civil Engineering, Prof. of Bacteriology, Prof. of Sanitary Engineering, and Research Assistant, at the Engineering Experiment Station, Oregon State University, Corvallis, Ore. *Journal WPCF.*, August, 1961.

Activated Sludge Shock Loading

Any rapidly occurring or immediate change in the chemical or physical environment of the activated sludge process might be classified as a system shock because it may seriously affect the established metabolic patterns in the aerator. Such change may possibly affect the flocculating and settling characteristics of the system. Three major types of phenomena may be defined as follows: 1) The Quantitative Shock Load, of which a rapid increase in BOD loading is the best example; 2) the Toxic Shock Load, which involves an influx of organics or inorganic elements, radicals or compounds which wholly or partially inhibit or damage the existing metabolic pathways or disrupt the established physiological condition of the microbial population; 3) the Qualitative Shock Load, involving a change in the chemical structure of the substrate constituting a serious shock to the activated sludge system. Methods and techniques for studying these phenomena were developed using a continuous-flow activated sludge system with a standard waste of constant composition. From these studies it was concluded that: 1) Removal of the soluble substrates studied can be adequately explained on the basis of known biochemical reactions; 2) for a temporarily successful response to a quantitative shock load an extracellular source of nitrogen is not necessary; 3) for a successful re-

Backhoe-Loader Saves Money on Trench Job

FOR trimming out and shaping the bottom of a large sewer trench, Herbert Van Name, contractor, Staten Island, New York, used a Case 420 backhoe and loader. It was estimated that the unit did the work of at least a dozen men under the wet and muddy conditions existing in the trench. The backhoe-loader was lowered into the trench between the shoring timbers by a crane. Maneuverability and low profile permitted the unit to perform in the narrow space available and under the shoring timbers, despite the mud and water. In addition to reduced cost, work was materially speeded up.



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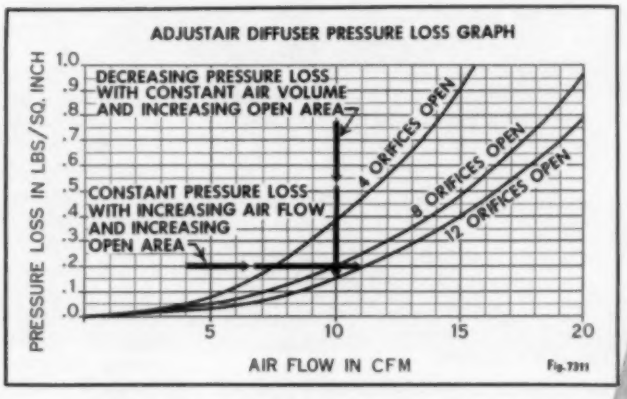

Graph illustrates that with AdjustAir diffusers the volume of air may be increased and pressure loss held constant . . . or air volume held constant and pressure loss reduced . . . by simply increasing the number of open orifices in the AdjustAir.

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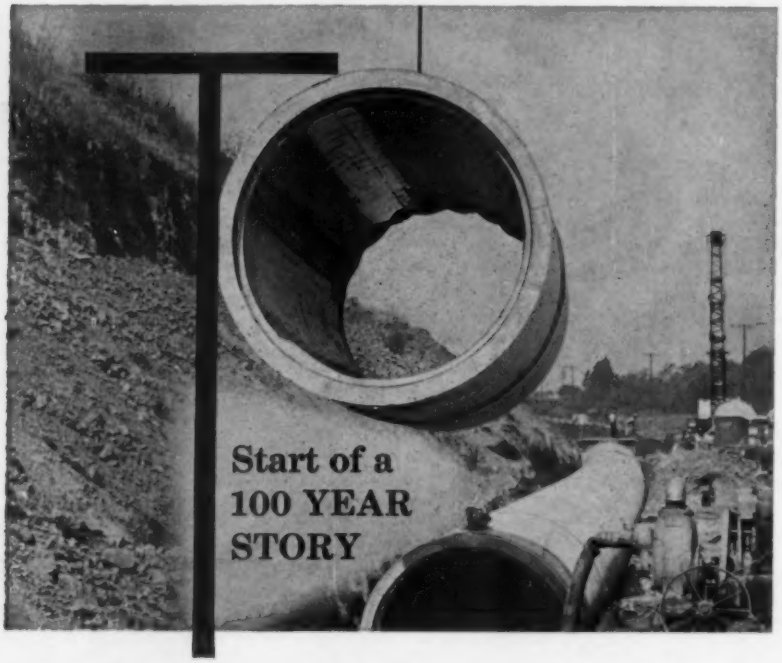

This reinforced concrete sewer will be in service generations from now, because concrete surpasses all other materials. Most concrete sewers do not require protection, but when strong chemical effluents or oxidized H_2S are a problem, only T-LOCK AMER-PLATE provides positive protection. T-LOCK AMER-PLATE is a high molecular weight polyvinyl chloride sheet which is cast into the concrete while in the process of manufacture.

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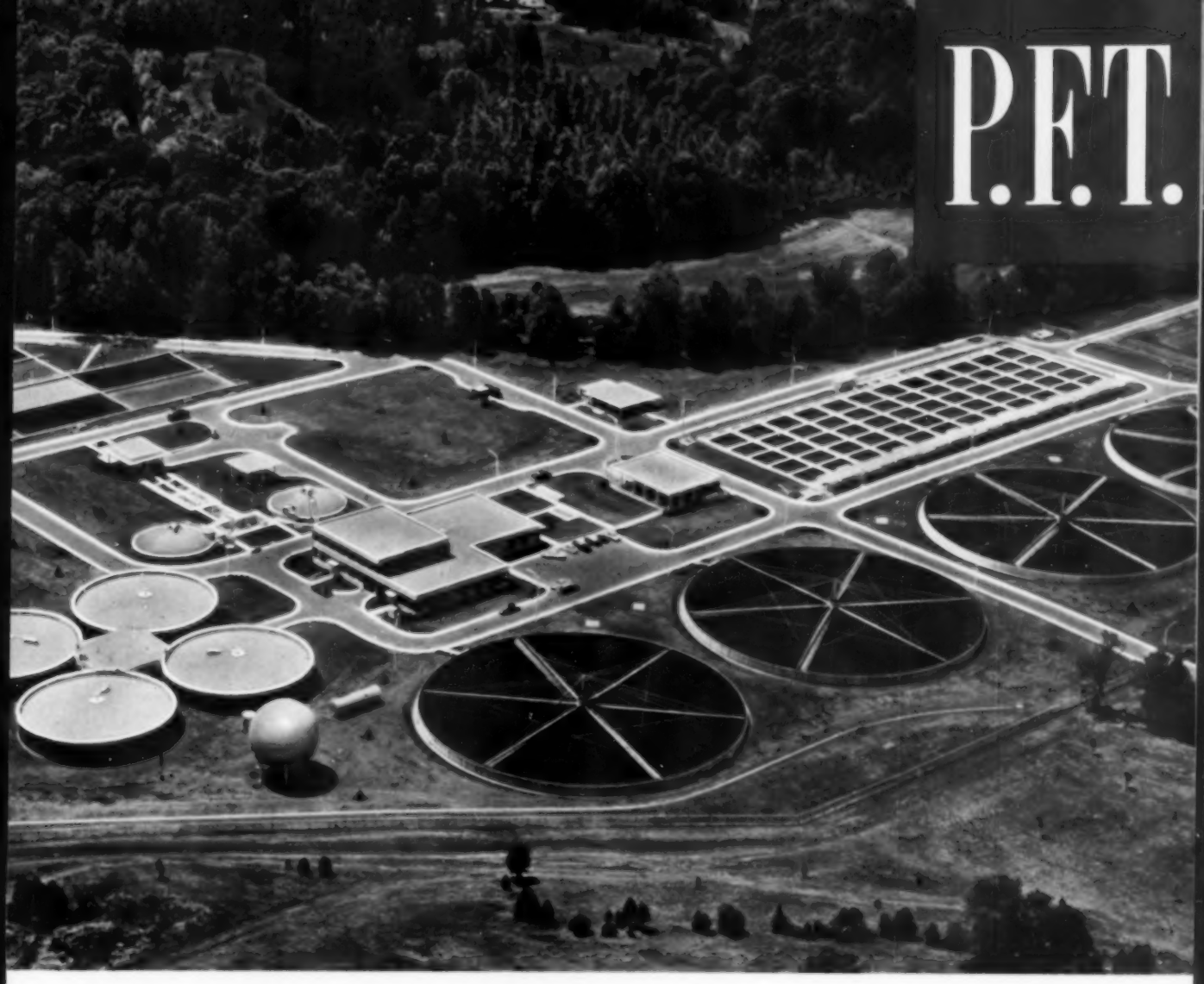
sponse to the qualitative shock loads studied an extracellular source of nitrogen is required; 4) the time required for response to a qualitative shock loading and the rate of substrate removal under this condition for any given sludge is dependent on the specific chemical structure of the compound introduced.

"Quantitative and Qualitative Shock Loading of Activated Sludge Systems." By A. F. Gaudy and R. S. Engelbrecht are respectively, Assistant Professor and Professor of Sanitary Engineering, University of Illinois, Urbana, Ill. *Journal WPCF*, August, 1961.

Hollywood Licked Infiltration

When infiltration seriously threatened the capacity of its new $4-million sewer facilities, raised the spectre of salt water corrosion of pumps, pyramided the cost of sewage pumping, compounded operation problems of its sewage treatment plant, and caused other technical and fiscal problems, the City of Hollywood, Florida, called on new methods to lick these difficulties. As a result of an intensive in-sewer photographic and closed-circuit television survey, followed by an equally energetic program of leak repair and sealing, the following was accomplished: 1) One of the system's seven lift stations, which formerly required an 8-inch panic pump in addition to regular pumps to handle flows, dropped from a 22-hour-a-day operation to less than one hour a day; 2) one four-block stretch of line, constructed originally under trying circumstances of ditch-deep water fed by underground streams, was repaired at a cost of $10,000 instead of being abandoned; 3) the need for constructing a new $175,000 sewer was eliminated by sealing leaks in the existing sewer; 4) treatment plant processes were returned to normal; 5) improved sewage handling conditions resulted in a sharp reduction in pumping costs in one year from $10 per mg to $7.30 per mg. The leaks in the sewers, resulting in excess amounts of infiltration, were located by an ingenious simple device for measuring sewage flow at any manhole location. After the approximate location of the leak was determined, photographic and closed-circuit TV equipment was used to obtain a more exact location. The repair of the leaks involves a pressure grouting procedure which serves, in effect, to



This is Winston-Salem's Waste Treatment Plant Showing P.F.T.'s 200' Rotary Distributors and P.F.T.'s 90' Floating Cover Digesters with P.F.T.-Pearth Gas Recirculation Systems.

Superior Waste Treatment at Winston-Salem . . . . Now and for Years to Come

Winston-Salem, "City of Culture, History and Industry" is a big city with big ideas; ideas that are materializing and consistently shaping the future of this southern metropolis.

In its metropolitan area there are over 280 diversified industries. Here you'll find the world's largest cigarette manufacturing plant—the world's largest men and boys' knit underwear manufacturer—the world's largest circular knit hosiery mills—and—one of the world's finest waste treatment plants.

This "bigness" spells out civic cooperation. In fact, Winston-Salem's motto is "The City Founded Upon Cooperation". Winston-Salem's growth has been planned and these plans are expanding.

All of this tremendous industrial and domestic growth demanded the ultimate in safe sanitation. Here again "the city of cooperation" took action and the construction of this waste treatment plant was the result of present and future-minded planning.

Excellently engineered this waste treatment plant places Winston-Salem among the nation's leaders in fulfilling their obligation not only to the community but its downstream neighbors as well. Winston-Salem knows that modern waste treatment equipment—P.F.T. equipment—and a modern waste treatment plant are truly a civic asset. Please turn the page for the story of P.F.T. at Winston-Salem.

Manufacturers and designers of fine waste treatment equipment since 1893, the Pacific Flush Tank Company take pride in being a major participant in furnishing equipment for the Winston-Salem plant.

P.F.T. Rotary Distributors, 200′ in diameter, are designed to distribute 25.0 mgd of settled sewage uniformly over the entire area of each filter bed. Especially designed P.F.T. bronze forged spreader jets assure the most effective operation of these filters—these biological giants are the heart of this treatment plant.

The four 90′ diameter Digesters are equipped with P.F.T. Floating Covers; three of these units have the P.F.T.-Pearth Gas Recirculation system and the fourth has provisions for the addition of the P.F.T.-Pearth equipment without taking the units out of operation.

External Heaters and Heat Exchanger units by P.F.T. allow complete accessibility in a compact unit of high thermal efficiency. With these P.F.T. #750 heaters uniform temperatures are maintained throughout the digestion system. Other P.F.T. equipment in this digestion system includes Gas Safety Equipment, Supernatant Equipment, Floating Cover Gauge Boards with High and Low Level Alarms.

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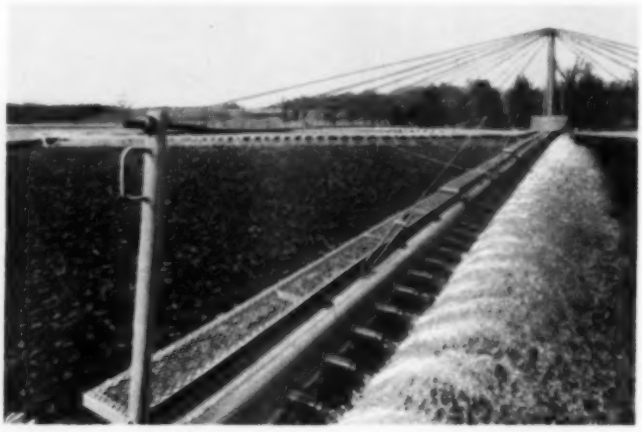
One of the three P.F.T.-Pearth Gas Recirculation Systems.



Close-up of P.F.T. Rotary Distributor arm showing P.F.T. Spreader Jets.

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The Winston-Salem Waste Treatment Plant was designed by the Consulting Engineering firm of Piatt & Davis and Associates of Durham, N.C.

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create a void in the ground surrounding the leaking area and to introduce a concrete diaper around the joint. The cement grout is forced into the leak providing permanent repairs which are able to withstand interior and exterior hydrostatic pressures. Another method of repairing leaks is the internal application of a chemical seal, forced-sprayed and wiped on the inside of the line. The sealing compound has a short gel time which facilitates the sealing process. Several diagrams accompany this article showing the two methods of stopping infiltration.

"Hollywood Licked Infiltration—Before It Licked Hollywood." By Joseph W. Watson, City Manager, Hollywood, Fla. *Wastes Engineering*, August, 1961.

Gloucester Sewage Works

The City of Gloucester, England, is constructing a sewerage system and treatment works which will cut pollution of the Severn River. The drainage program now in progress was started in 1950 and by 1963 will be completed. It has been designed to deal with a dry weather flow of 4 mgd, based on a water consumption of 50 gpcd for a population of 80,000 inclusive of industry. The construction program has been planned, designed, and constructed in stages in line with restrictions on national expenditures by the Ministry. The scheme in its final form comprises a pumping station and treatment works for partial treatment of the sewage at Netheridge, the treatment works consisting of screen, detritus channels, disintegrators, sedimentation tanks, sludge digestion tanks and a sludge drying bed. There will be two primary and two secondary circular sludge digestion tanks, a sludge heater house and a gas holder. The gas produced by the digested sludge will be utilized in the dual fuel engines to drive the dry weather flow pumps. Due to the considerable sulfate content in the soil, the sewers with a diameter of 4 ft. 6 in. and above were designed of precast reinforced concrete segments, with the surface of the segments lined with 1½ in. of cement grout applied by a cement gun. When the sewerage scheme is completed and a number of minor sewers are relaid, the sewerage of the City of Gloucester will be safeguarded, flooding prevented for many generations and the pollution of the Severn River will be reduced.

"Gloucester Main Drainage Will Cut Severn Pollution." *Municipal Engineering*, August 4, 1961 (England).

Preventive Sewer Maintenance

The City of Fresno, Calif., has a combined sewer system serving its 140,000 people and the 2,000 acres of industrial property outside the city limits. To obtain the best service possible an excellent preventive maintenance program has been established in which the work is organized on a precision schedule. One of the most important items in low cost sewer maintenance is proper original engineering in which manhole spacing, grades, sewer sizes and good workmanship are given primary consideration. Inspection of new replacement sewer lines, whenever possible, should include the full moon test, hydrostatic test and ball test. An accurate plan of all the sewer lines in the city, including a large-scale map of the entire sewer system, is essential to a good sewer maintenance program. In the Fresno system, the foreman and superintendent have radio-equipped pick-ups so they can dispatch sewer

NORTH CANTON'S NEW SEWERODER HAS RESERVE CAPACITY FOR FUTURE SEWER ANNEXATIONS

Ohio's new city gears up for growth

A. J. Haun, Water & Sewer Supt., watches SeweRodeR in action as John Fleischman, machine operator, handles simplified controls. Board of Public Affairs, which concurred in selection of the SeweRodeR, consists of Carl O. Sponseller, Pres.; George W. Post, L. Earl Waltenbaugh, Members; and Lester L. Broucher, Clerk.

Rapid growth during the past ten years resulted in North Canton, Ohio becoming a City in 1961. Even faster growth is anticipated through annexations, and the City officials have wisely taken this into account by long range planning.

A major problem created by the rapid expansion is the ability to provide adequate sewer cleaning service for today's needs, plus reserve capacity for the future. After careful investigation, Water & Sewer Supt. A. J. Haun found that by purchasing and truck-mounting a SEWERODER, a single rodding crew could easily maintain the entire system on a preventive maintenance basis. He says, "we find the SEWERODER to be the easiest machine to set up and operate that we have ever had."

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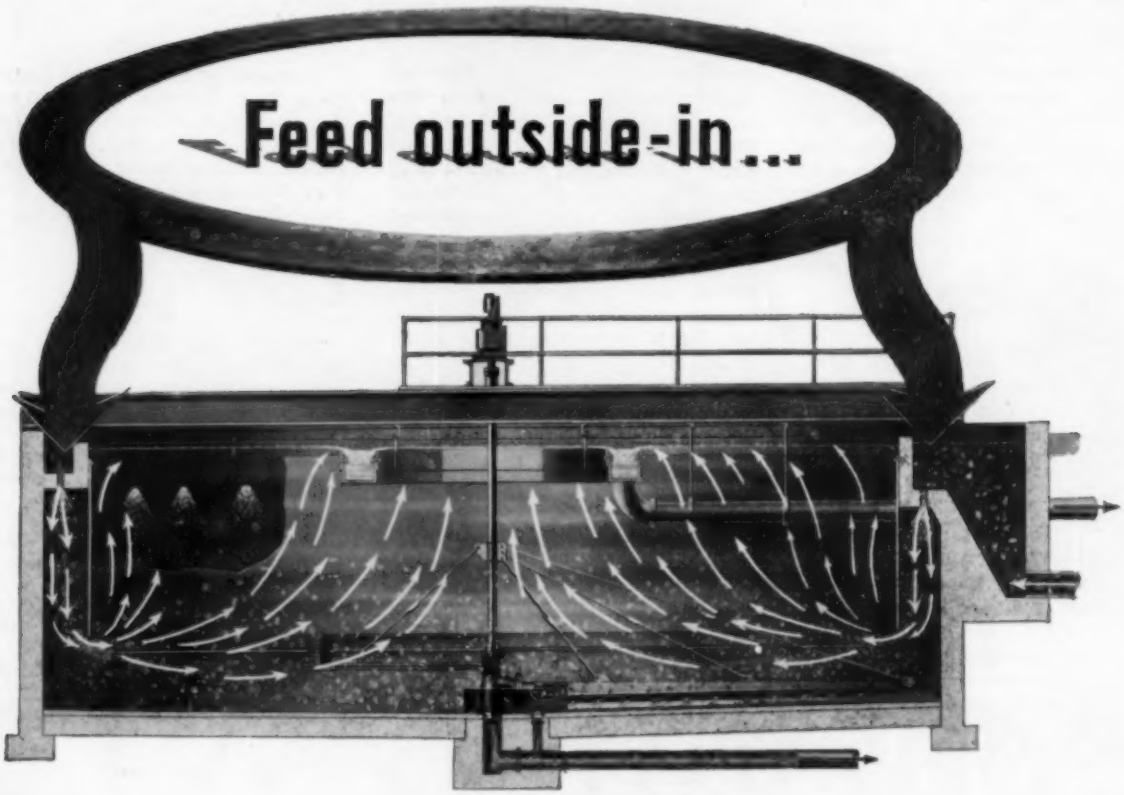

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crews on routine maintenance to the location of a stoppage or other complaint within minutes. An excellent safety record has been maintained as a result of the work of the Safety Committee and the maintenance men following closely the procedures set down in the departmental Operational Procedures Manual. For example, any employee entering a sewer manhole must use the required safety equipment and must log in the field crew book the use of explosimeter, hydrogen sulfide detector, oxygen deficiency lamp, hose mask and P-type harness. The public relations program is recognized as a very important part of every employee's dealings with the public and his fellow employee.

"Preventive Sewer Maintenance." By Alex Stenman, Div. Supt. Streets & Sanitation, Fresno, Calif. PUBLIC WORKS, September, 1961.

Activated Sludge Reaeration

Modification of conventional activated sludge incorporating the reaeration of sludge has been utilized under various titles but the process is essentially the same in all cases. The process embraces three functional steps as follows: 1) Relatively short aeration period of a mixture of raw waste and biologically active sludge (adsorption); 2) separation of the biological sludge laden with organics from its associated treated liquor by sedimentation (clarification); 3) reaeration of the settled biological sludge prior to admixing with the incoming raw waste (oxidation). A review of the operation of several plants indicates that the key to successful operation of any activated sludge system is to maintain the proper ratio of food to organisms, ie, raw waste flow (food) to return sludge rate (organisms). Advantages for the sludge reaeration process over conventional activated sludge include the following: 1) Separating the adsorption and oxidation processes that occur in the same unit in conventional practice into different units afford greater flexibility in the control of the process, because each is then independently controlled; 2) it is more capable of handling shock loadings by virtue of the reservoir of sludge contained in the sludge reaeration unit; 3) the need for reduced aeration time results in smaller tank capacities, less area, and lower capital expenditures.

"Operating Experience With Activated Sludge Reaeration." By Edward R. Grich, Consulting Sanitary Chemist, Paterson, N.J. *Journal WPCF*, August, 1961.

Other Articles

"Coliform Distribution in Central Texas Bays." Relation to rainfall and river flow turbidity, salinity and pH. By Carl H. Oppenheimer, Institute of Marine Science, University of Texas, Port Aransas; Neil B. Travis, Texas State Dept. of Health, Austin; and Howel W. Woodfin, Corpus Christi-Nueces County Health Dept., Corpus Christi, Texas. Water & Sewage Works, August, 1961.

"Electrification of a Sewage Pumping Station." Baltimore's $1,085,000 station furnished with 3 triple-expansion pumps driven by Corliss steam engines. By C. E. Keefer, Sewerage Engineer, Bureau of Sewers, Baltimore, Md. PUBLIC WORKS, September, 1961.

"Water Conservation Scheme Proposed on River Severn." Abstractions needed to meet rising Midlands demand. The Surveyor and Municipal and County Engineer. 29 July, 1961. (England)

"Compact" sewage treatment plants

Sparjair plants provide safe, efficient and odorless sewage treatment — equal to "big city" systems in everything but complexity and operation cost. They combine screening, aeration, sludge removal, aerobic digestion and chlorination in one compact, self-contained unit to provide the most effective treatment obtainable in any common-wall plant. Available in designs to handle population equivalents of 50 to 5000. Installations range from rural schools to small cities. Sparjair plants may be located anywhere—above or below ground—utilizing concrete or steel tank construction. Easiest to operate—primary settling, sludge pumping and anaerobic digesters eliminated—requiring considerably less attention than a complicated plant layout. Our organization is the oldest and most experienced in compact aeration plants. A qualified process engineer is available to work with you. Write for bulletin 19-S-94 for process and operating details. Layouts are available.

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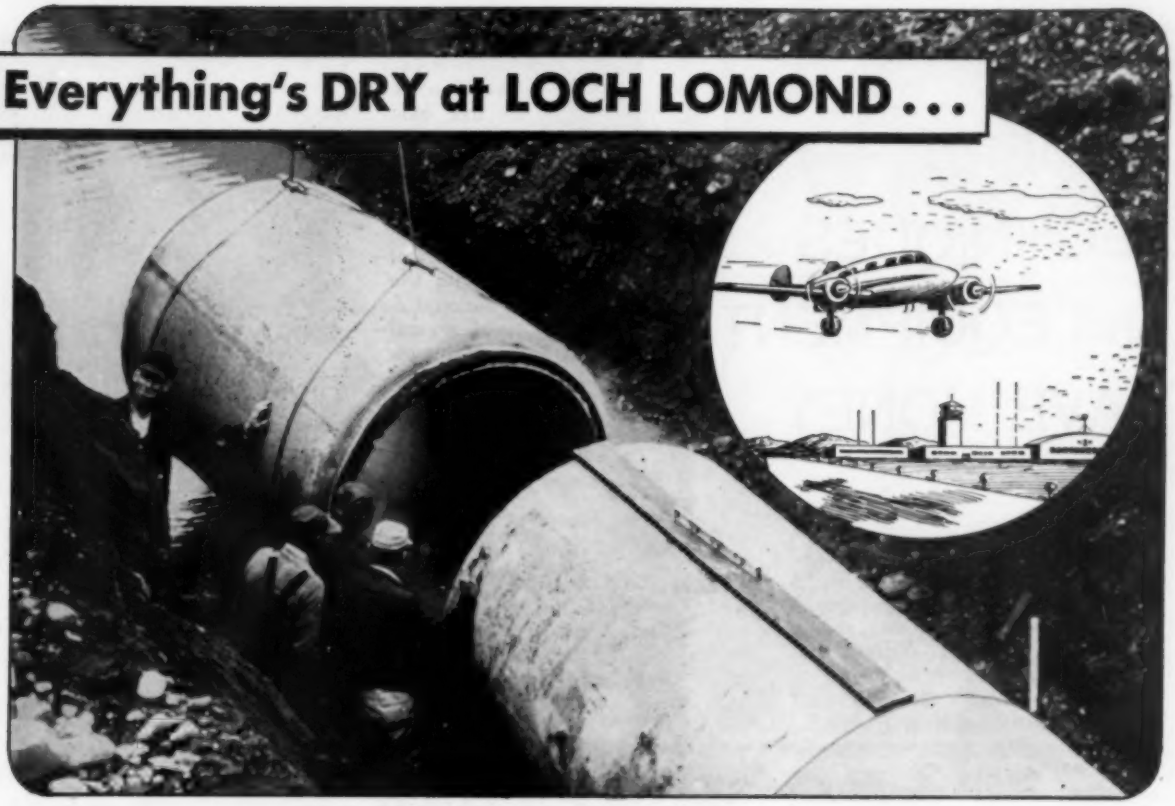

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Neither impact load of aircraft, nor dead weight of deep fill or other overburden can cause leaks in the joints of this water transmission line which passes *under* the Saint John Municipal Airport. TYLOX *Flexible* Gaskets couple the pipe! These safely absorb vibrations, and provide ample joint deflection to allow for soil stresses, either natural or applied. Tylox Gaskets were used, not only to take advantage of these features, but to assure full water flow without leakage loss; and to prevent possible contamination by infiltrated ground water. Since Tylox Gaskets are acid-resistant, designers can also be sure the Joints will *stay* water-tight and root-proof for the life of the pipe itself.

Canadian British Engineering Consultants of Halifax, N. S., designed the project for the City of Saint John, whose own work force installed the line. The 60" x 8' reinforced T & G pipe was manufactured by Jos. A. Likely, Limited, Saint John, N. B.

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MODERN TECHNIQUES and EQUIPMENT SAVE MONEY

● **PURCHASE of salt in bulk and use of labor-saving equipment for ice control purposes saved Lancaster about $6,000 during the past year.**

MONEY-SAVING developments in civic administration in Lancaster, Pa., have resulted from sound and careful planning; courageous and risk-taking action; and public co-operation. Mayor Thomas J. Monaghan supplied the leadership to review and study all municipal house-keeping services—from ice and snow control to radio communication. J. Haines Shertzer, city engineer; Street Superintendent William Foltz; and Public Services Supervisor Frank J. Rice, Jr., aided Mayor Monaghan in this program.

A thorough study of ice and snow control methods and equipment was made last year at Mayor Monaghan's suggestion. Findings indicated savings in material and labor could be made through changes in salt treatment techniques. After consultation with the supplier, Salt Service Company of Philadelphia, it was decided to change from using bagged salt to bulk stored rock salt. A survey of city-owned salt spreading equipment further indicated that the old equipment was inadequate and an investment was made in three Tarco "Scotchman" spreaders equipped for one-man operation.

Accurate cost records based on the 1960-61 season proved that these studies and the resulting action really paid off: 560 tons of bulk rock salt were purchased at a saving of $3,300 as compared with the same amount of bagged salt. By using bulk salt, labor costs were reduced $2,700. The Tarco "Scotchman" spreaders contributed both in material savings and in the reduction of labor costs. When bagged salt had been used each truck had to have a crew of three men. The new driver-controlled spreaders applying bulk salt resulted in an immediate labor saving of $4.83 per hour. Even after paying for the new spreading equipment the first year, Lancaster saved $5,098.50 by changing to this more efficient method of ice and snow control. Besides returning a sizable net saving, the Lancaster public works department now provides faster bare pavement maintenance with fewer traffic jams and accidents.

The pavement resurfacing problems were next studied. The old method was to use standard surface treatment. In 1960, fifteen miles of city streets were resurfaced with a premixed asphaltic concrete known in Pennsylvania as FJ-1. This was machine-applied in depths of from ½ to ¾ inch, providing a level wearing surface. There were no loose stone chips to bother traffic or clog the drainage system. While initially more expensive than the older method, the longer anticipated life of this new pavement will eventually prove cheaper—only two small holes developed in 15 miles of streets after a very hard winter. More of this new pavement resurfacing is being planned.

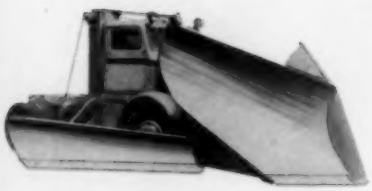
Parked automobiles were the biggest obstacle to efficient street cleaning in Lancaster, as they are in most cities. The Mayor set up a new street signing program which stopped the parking of automobiles for 3 hours one day each week. Sweepers now work on a routine schedule to clean all streets during the no-parking interval.

A study of Lancaster's sewer cleaning techniques revealed that use of obsolete equipment resulted in higher costs. The 35-year old bucket machine and the 25-year old rodding machines were replaced with new equipment manufactured by Flexible, Inc. With this new equipment sewer cleaning jobs which formerly required 6 to 7 hours are now completed in less than 1 hour. Sewers are cleaned on a routine basis. Obstacles in sewers which could not be removed by the old equipment are now removed quickly and efficiently and at a reduced cost.

Studying the sewer cleaning situation also revealed another important problem—the deterioration of old single ring brick sewers. Many of these 24-in. to 48-in. sewers were built around 1890. Most are in various stages of deterioration and collapse; some are so bad that inspection by entering the line is dangerous. Modern television sewer inspection equipment is being used to locate the danger spots for immediate reconstruction. A plan of routine sewer inspection by the television technique is being adopted.

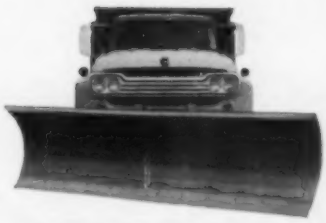
Based on reported experiences of other cities, the Mayor decided to test short wave radio sending and receiving equipment to determine if this modern tool could save money for Lancaster taxpayers. During early 1960, short wave radio demonstrations were made by the Keystone Communications Company using Aerotron equipment. Ability to locate city owned equipment; to rush mechanics to equipment in trouble; to expedite snow removal; and to hurry equipment from one spot to another all indicated that much time and labor could be saved. The city secured an FCC short wave operating license; and leased 10 mobile units and a base station from Keystone. As a result of experience from these units, the radio communication network will be expanded to have a 100-watt base station and 40 mobile units which will more efficiently co-ordinate the activities of the departments of streets, water, sewers, parks, traffic and car pool. □□□

SNOW PLOWS



V-PLOWS—from 8′ to 9½′ swath—nose heights 30″ to 54″.

WINGS—10′ to 12′—partial or complete hydraulic control.



STRAIGHT PLOWS—reversible—9′ to 12′ lengths—heights from 29″ to 60″.

TAPER PLOWS—9′ to 12′ length of cutting edge—full range of heights and adjustable or one-way.

RIGHT-V-LEFT—hydraulic control in cab converts right-hand taper to "V" and to left taper while truck is in motion.

PLUS CUSTOM DESIGNS AND SIZES TO MEET EVERY POSSIBLE REQUIREMENT

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Begins With A Vermeer
POW-R-DITCHER

If you want more ditch for your dollar, you can't beat the 524T POW-R-DITCHER . . . the lowest priced BIG ditcher on the market! Digs 8″ to 24″ wide at speeds of 1′ to15′ per minute. Has 2-way dirt conveyor and hydraulically controlled steering with separate steering lever for each track. A self-propelled one-man operated machine that's ideal for contractors, municipalities, utility companies and institutions.

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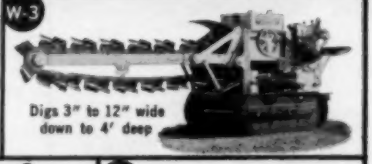
PICK THE POW-R-DITCHER TO FIT YOUR NEEDS

4T — Digs 6″ to 14″ wide and 4½′ deep

W-3 — Digs 3″ to 12″ wide down to 4′ deep



W-1 — Digs up to 8″ wide (tracks or tires)

3P — Fits all standard 3-point tractor hitches

Please send me FREE information and prices on the complete Vermeer line of self-propelled POW-R-DITCHERS

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☐ Also send complete information on your new hydraulically operated back filler . . . the POW-R-DITCH-FILLER

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Monitoring Sewer Defects by Television

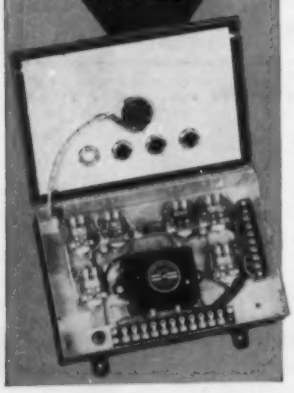
H. LaMAR TREFSGER
Director of Service,
Maple Heights, Ohio

SEWER inspection by television saved our community thousands of dollars during the summer of 1961 in solving sewerage and drainage problems on Shirley Avenue in Maple Heights. We had heard of using closed circuit television but were a little hesitant because of the newness of this technique.

In June, following several consultation periods with representatives

CONTROL ALL ENGINE OPERATIONS *Automatically*

Synchro-Start MODEL 1436M4



- Full automatic starting from any pilot switch.
- Interrupted cranking with over-all time limit.
- Disconnects starting motor when engine begins to run.
- Three position "AUTO" "MANUAL" "OFF" master control switch.
- Shut-down and individual signal in event of low oil pressure.
- Shut-down and individual signal in event of high water temperature.
- Shut-down and individual signal in event of engine overspeed.
- Failure light in event engine refuses to start.
- Provisions for connecting remote failure alarm.
- Oil pressure time delay to permit starting on zero oil pressure.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE.
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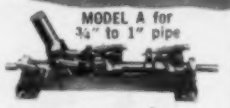
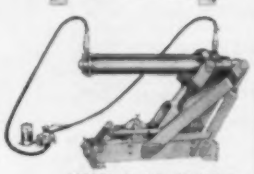
Trojan Pipe Puller & Pusher
installs or renews pipe under pavement
in less time than required by any other machine!





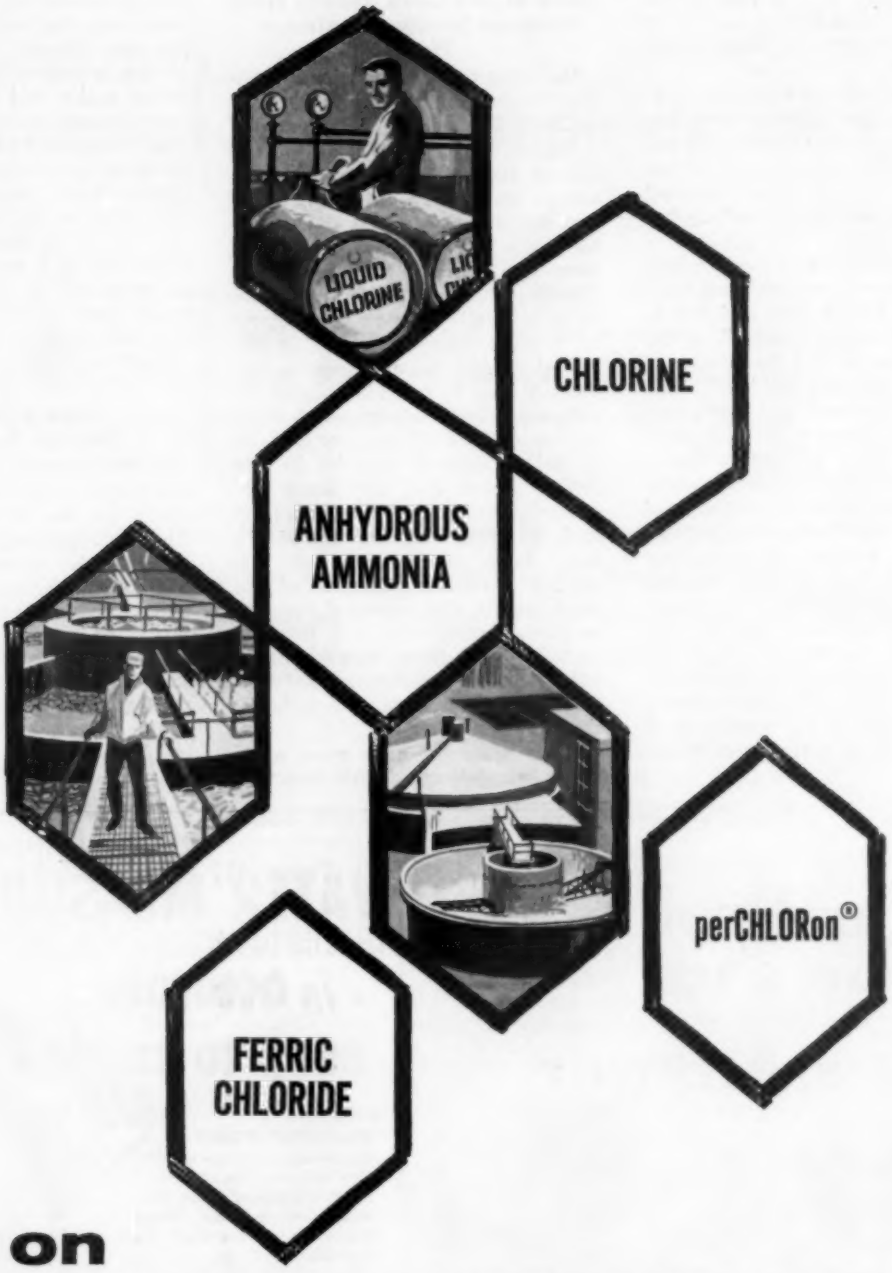
Exclusive continuous action, which eliminates all resetting of grip, does the trick!
The Trojan combines pushing and pulling operations in one machine —eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

Model A weighs 65 lbs.—requires only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible. Is also available for ½" pipe.

Model B (manual, hydraulic or air powered) needs only a 6' trench —has 3 speeds for different soils —is reversible in 30 seconds. Push pipe comes in 30" lengths, assures straight travel.

Write today for full details!

The TROJAN Manufacturing Co.
1114 Race Drive • Troy, Ohio



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FOR EFFECTIVE, EFFICIENT WATER AND SEWAGE TREATMENT

Whether your needs are a few cylinders and drums or multiple unit rail cars . . . you can be sure of dependable chemicals . . . and fast, reliable delivery every time.

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of Inspectoline, Inc., a firm which specializes in this service and H. P. Peterson & Associates Engineering, action began.

The closed circuit television system was equipped with its own light source. The operator handles the remote controlled camera and adjusts the lighting from an air-conditioned mobile television studio and control room.

After an initial probe of 99 feet, tree roots were discovered, and leaks were found at 104, 206, and 218 ft. respectively. Roots appeared on the monitor again at 262 feet, followed by leaks at 266 and 283 feet.

It was discovered that some sections of the sewer, installed several years ago, were infiltrating badly. New sections, inspected by other methods, had failed to reveal sand and gravel that had partially filled the line. As a result, the contractor cleaned and flushed these sections before receiving our final acceptance.

Because of this and other knowledge gained through the use of the closed circuit television system, we are considering purchasing a system and employing it for inspection of all new work as a condition of acceptance.

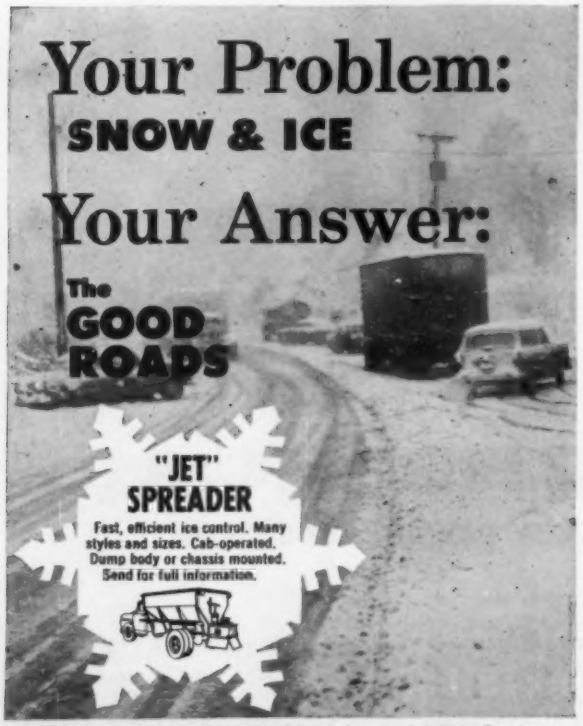
Cities Report Good Results from Package Sewage Treatment Plants

On a recent questionnaire sent to City Engineers the Editors of PUBLIC WORKS asked: What is your observation and/or opinion on the result of treatment by prefabricated sewage treatment plants? The question was answered by 71 cities from 32 states. Of the 60 replies which were applicable, 23 rated results as excellent, very good or good and 18 as adequate, fair or satisfactory. In 7 cases, plants were being installed or had been in service too short a time to provide a basis for judgment. Installations were rated as not satisfactory, poor or bad by 5; and as causing odor by 1. Two replies stated that the plants appeared satisfactory when operating at below rated capacity or with a small load. One emphasized that regular servicing was needed for good results. One reported the unit as already overloaded and two had no comments. Other remarks were not applicable or indicated that such plants were not under the jurisdiction of the replier.

As is often the case, some engineers misunderstood the intent of the questions or local conditions were such that a direct answer was not easy. Though it was the intent of the question to exclude home septic tanks and individual home installations, the replies in a few cases appeared to include these. For instance, one midwest community of about 25,000 population reported 100 units as in bad shape. These were no doubt individual home installations and not package plants as described in this magazine for April, 1961, pages 111-113. Excluding such replies, the 71 cities reported about 150 prefabricated units.

State Grants for Sewage Treatment

Payments totalling $1,765,211 were authorized in December, 1960, to be made by the Pennsylvania State Health Department under a state law which makes municipalities eligible for annual payments up to two percent of sewage treatment plant (or interceptor) construction costs. Payments are to be applied toward annual costs of operation, maintenance and repair. Actual percentages paid each year vary, depending on appropriations made by the General Assembly.

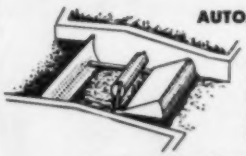


Manufacturers of Snow Plows, Road Spreaders, Leaf & Litter Equipment
Good Roads GOOD ROADS MACHINERY CORPORATION
MINERVA, OHIO

WATER MEASUREMENT
. . . accurate
easy to read

PARSHALL MEASURING FLUMES
Easy to read, accurate water flow indicator. Not affected by silt deposits or stream velocity. Easy to install. Heavy gage steel; will not warp, swell or crack.
- Self-cleaning
- Easy to read
- Low head loss
- Throat widths: 3" to 10'

WATER WELL SCREEN FOR EVERY SOIL CONDITION. Choice of perforations and 4 field joints. Stainless, and galvanized steel. From 6" to 36" diameters.


AUTOMATIC WATER CONTROL GATES
Accurately control water level upstream or downstream, in canals, ditches and reservoirs, regardless of flow. Eliminates washouts, flood damage and labor costs, (no gate keeper necessary).

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BLESSINGS OF DIVERSIFICATION

In the past year the pace of sales and application of the Coilfilter, especially on Fresh Solids Dewatering, has continued to hold up remarkably well when we realize that while the disposal of sludges continues to be a vexing problem, other matters in the Sanitary Field have become more pressing.

On a nation-wide basis it is apparent that better effluents are required to keep pollution under control and we are hearing the word "tertiary" treatment used more frequently. We are also watching the gradual evolution of Federal participation in pollution control aid in the drainage basins.

Our research and development people have been cognizant of these ever growing needs and we are pleased to note that the line of equipment we manufacture is well suited for the needs of the Sanitary Field. The range includes such items as the homely ejector at one end and advanced electronic devices at the other extreme.

All items of equipment we manufacture are built to meet the needs of the Operator and are conservative in design. Our good reputation was built on this philosophy and we are indeed happy with the eminent position gained.

Respectfully,

T. R. Komline

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ENGINEERING CORPORATION
PEAPACK, NEW JERSEY, U. S. A.
BRAMPTON, ONTARIO, CANADA

BLOOMINGTON ALL-AMERICA CITY

THOMAS L. LEMON
Mayor

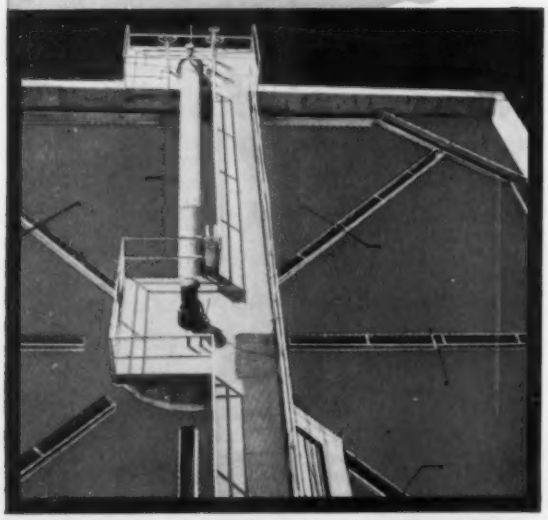
INDIANA

CITY OF BLOOMINGTON

WATER DEPARTMENT
LESTER THORNTON, SUPT.

NOW SAVES OVER $30,000.00 ANNUALLY

IN TREATING 6,000,000 GALLONS OF WATER DAILY WITH . . . . . *Mogul Claracel!



THOMAS L. LEMON
Mayor

LESTER THORNTON
Supt. of Water Dept.

IRWIN L. DICKSTEIN
Chief Chemist

The City of Bloomington operates two water clarification and filtration systems. One is a settling basin system, the other a clarifier system. Each system treats approximately 3,000,000 gallons of influent water per day. Solids carry-over was a consistent and continuing problem . . . especially during the spring rain season it affected the quality of the delivered water, the efficiency of the systems and the length of filter runs.

The addition of MOGUL CLARACEL showed the following results:

- * Better and larger floc formation
- * Substantial reduction in solids carry-over
- * Filter runs increased from 12 to 24 hours
- * Less water required for filter backwash
- * Better filtration — "packing" of filters eliminated
- * Cleaning of filters now done more easily in less time
- * Delivered water of highest quality

The improvement was so outstanding with Mogul Claracel that the water treatment results and savings have been endorsed by the city officials illustrated.

*A NEW SERIES OF COAGULANT AIDS

here are the savings

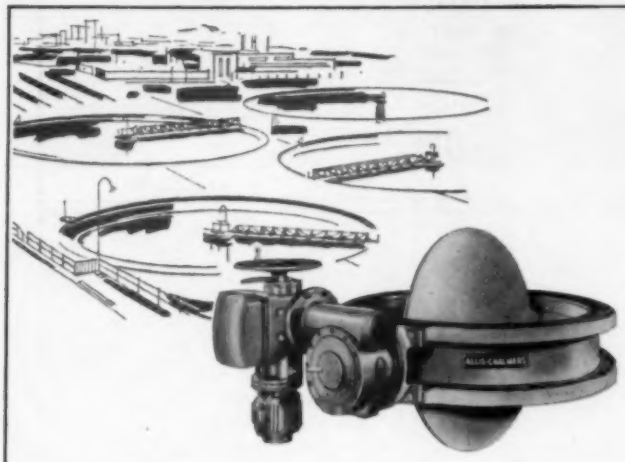
COST PER DAY	SETTLING BASIN SYSTEM BEFORE MOGUL CLARACEL	SETTLING BASIN SYSTEM AFTER MOGUL CLARACEL	SETTLING BASIN SYSTEM DAILY SAVINGS	CLARIFIER SYSTEM BEFORE MOGUL CLARACEL	CLARIFIER SYSTEM AFTER MOGUL CLARACEL	CLARIFIER SYSTEM DAILY SAVINGS
Alum	$73.20	$36.60	$36.60	$122.00	$61.00	$61.00
Lime	30.00	25.50	4.50	11.25	7.50	3.75

Treatment Savings Per Day	$105.85
Less Cost of Mogul Claracel	13.00
Net Savings Per Day	$ 92.85
Annual Savings	$33,890.25

The North American
MOGUL
Products Company

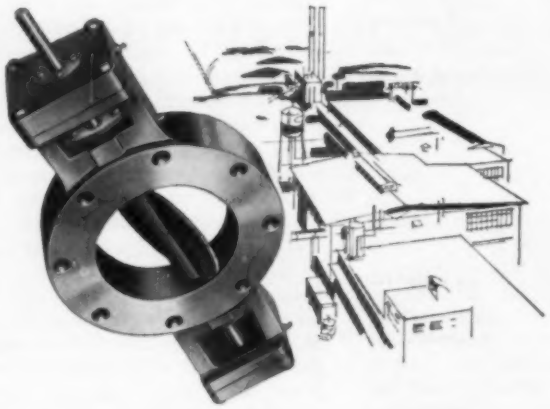
STANDARD BUILDING • CLEVELAND 13, OHIO

ALLIS-CHALMERS

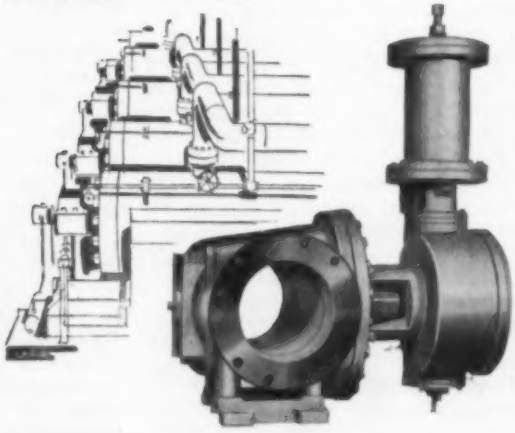


BUTTERFLY VALVES — For liquids or gases — uniform control in all positions, fast positive regulation and closure, minimum pressure drop. Compact and lightweight. Sizes from 1 in.

BALL VALVES — Easy manual shutoff under adverse conditions, and up to 150 psi. Slight wedging action gives unusually drop-tight closure. Sizes: 12 to 48 in.



WAFER VALVES — A new design of butterfly valves with space-saving flexibility, suited to most any type of operation. Sizes from 3 to 36 in., including high-pressure types.



ROTOVALVE — A cone valve suited to virtually any type of operation or location. Offers the least pressure loss, greatest initial shutoff, controlled closing time, positive seating.

Now: for power plants, sewage and water works —

a full line of rotary valves

Serving you even better through a broader line—Allis-Chalmers offers the finest in butterfly, ball and cone valves for industrial applications, power plants, sewage and water works. Also available are complete valving systems in standardized "packages" that provide *remote, telemetered control of valve operation.* These additions further round out Allis-Chalmers line that includes Angle, Needle, Relief valves, sleeve-type valves and accumulator systems. *For details, contact your Allis-Chalmers valve representative or write* **Allis-Chalmers,** *Milwaukee 1, Wisconsin.* Rotovalve is an Allis-Chalmers trademark.

A-1381

THE
HIGHWAY
AND
AIRPORT
DIGEST

Prepared by **L. G. BYRD,** ***Associate Editor***

Narrow Median Guard Rails

A series of studies of median barrier designs was made by the California Division of Highways, As a result, the narrow median on the Pasadena Freeway was protected throughout its length by a blocked-out metal beam barrier. The design provided for a corrugated steel top rail and a lower steel channel rail both bolted to 8 x 8-in. Douglas fir creosoted posts set on 6 ft. 3 in. centers. The top rail was fastened to an 8 x 8-in. offset block. The top of the barrier is 31 in. high. Timber posts were selected to provide a more resilient, smoother deceleration of a vehicle in the event of impact.

"California Shows How to Make Busy Highways Safer." *Wood Preserving News,* August, 1961.

Winter Maintenance of Urban Streets

A survey of Canadian municipalities indicates that over $30 million is spent annually on snow and ice control by these maintenance departments which own over $100 million of equipment for this purpose. The sudden, heavy snowfall provides the real measure of a city's preparedness. Most cities have an established plan of action and many recognize the importance of publicizing that plan in order to enlist the cooperation and support of industry and the general public. Major Canadian cities use the excellent weather forecasting service of the Meteorological Division of the Department of Transport of Canada, through direct communication by teletype or telephone. Good forecasting enables them to put crews into operation before a storm actually begins. This often is the key to battling successfully a major storm. Two-way radio communications offer the ideal for efficient operation of a snow-fighting organization. Where radio is lacking, other means of reporting and contact with crews and units must be devised. Early spreading of chemicals prevents bonding of snow to pavement surfaces and improves subsequent plowing action. Plowing generally starts when or before 3 inches of snow has accumulated.

"A CMU Manual—Winter Maintenance of Urban Streets." *Canadian Municipal Utilities,* August, 1961.

Slag Cement Study

Because portland blast-furnace slag cement is being used increasingly as an alternate for ordinary portland cement, the Bureau of Public Roads several years ago undertook a laboratory study of the strength, durability and other properties of air-entrained concretes prepared with portland blast-furnace slag cement as compared with concrete made with ordinary portland cement. The comparisons showed that slag cement concrete had lower early strength but higher ultimate strength than comparable portland cement concrete, according to both compressive and flexural strength tests. Slag cement concrete also had greater durability, under laboratory freezing and thawing tests. There was little difference between the two types in resistance to scaling, in outdoor tests where calcium chloride was used for de-icing. Tests under intermittent curing conditions indicated that the slag cement concrete may require more care and longer initial moist curing; but given adequate curing, the slag cement concrete tolerated greater variations in the amount of mixing water used. Slag cement with sufficiently high content may be suitable for use with highly alkali-reactive aggregate, since the slag content is beneficial in controlling the alkali-aggregate reaction.

"Final Report of Tests of Con-

County-Owned Motor Grader Has Multiple Duties

● **COLD-MIX asphalt surfacing is being spread by Galion 118 motor grader on Logan County, Ky., road. Most of the 199 miles of road in the county system are graveled and maintenance of these is primary job of grader; it is also used for snow removal.**

City of Phoenix reports—

Rubber-tired dozer key to equipment balance for two landfills

by WILLIAM McSPADDEN
SUPERINTENDENT OF SANITATION, PHOENIX, ARIZONA

Maintaining a balance of machines between two large sanitary landfills operated 14 miles apart can pose a real problem . . . especially when collection for one gets top-heavy in any given day . . . or when a bulldozer must go to the shop for repairs.

Addition of a rubber-tired 162 hp Michigan Model 180 Tractor Dozer to our landfill equipment fleet has solved this problem. Where it previously took a half-day to transfer a crawler bulldozer via lowboy from one landfill to another, the Michigan makes the trip across town under its own power in 45 minutes.

Michigan production on the fill is greater too . . . because of its faster operating speeds, output is *double* that of the 140 hp crawler formerly used. A truck-load of refuse thus takes only half the time to level. Also, the 35,850 lb Michigan and its big low-pressure tires compact 15% more refuse into the same space . . . with land costing $4,000 to $6,000 an acre, this is another important advantage!

27 mph job to job

At present we have a fleet of 152 trucks collecting and hauling 180,000 cubic yards of refuse and garbage monthly. The Michigan is on call to help at either landfill . . . trenching, stockpiling overburden, spreading and compacting refuse, spreading cover. Usually, though, it's assigned to the north landfill where it's handy for clean-up after storms. The Tractor Dozer can travel quickly (up to 27 mph) to where it's needed, clear away mud, sand and silt that has been washed onto streets, and be back at the landfill almost before it's missed. At times, too, the 162 hp rig handles utility jobs too rugged for our regular street maintenance equipment . . . such as dozing out three-foot diameter trees.

Dozes decomposed granite

One of the all-wheel-drive Michigan's most rugged tasks is cutting and dozing hard, decomposed granite into five-foot high ridges that later are spread as top cover. (See photo below). With its hydraulically controlled pitchable blade, the Michigan can exert full power on one point, forcing blade penetration. Its wide-base tires get excellent traction on the hard surface, resulting in good production without ripping.

No tire punctures— no downtime

In 10 months of operation we've had no tire punctures . . . despite the fact that the Michigan has been used continually to spread and compact all types of refuse. In fact, *tires are saving us about a dollar an hour over crawler track wear.* Also, machine availability is excellent, with no downtime for major repairs.

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

CLARK EQUIPMENT

2499 Pipestone Road
Benton Harbor 15, Michigan

In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

crete Containing Portland Blast-Furnace Slag Cement." Reported by William E. Grieb and George Werner, Highway Research Engineers, Division of Physical Research, Bureau of Public Roads. *Public Roads*, August, 1961.

Epoxy Coating for Bridges

Two bridges on the Garden State Parkway were protected with epoxy coatings in the fall of 1960. The bridges, 979 and 1,023-ft. long, both have 54-ft. wide reinforced concrete decks. Work was done by Parkway maintenance forces and included sandblasting to prepare a clean deck surface and filling of spalls and cracks with an epoxy troweling compound before the coating was applied. The epoxies were formulated using Union Carbide's epoxy resin, ERL-2774, and Thiokol's flexibilizer. Coating operations were performed by a 3-truck caravan and a 10-man crew. The epoxy was sprayed on the surface and an emery grit brodcast over it using a sandblasting gun. A 13½ x 1000-ft. lane was sealed in two hours. Overall cost for the two bridges was $12,517 or about $1.05 per sq. yd. The unit cost breakdown was about 95 cents for material and 10 cents for labor.

"Epoxy Coatings Planned for Parkway Bridges." By Harold W. Goldberger, Engineer of Maintenance, New Jersey Highway Authority, Garden State Parkway, Red Bank, New Jersey. *Roads and Streets*, August, 1961.

Rubber in Asphalt

The largest installation in Ohio of an asphalt-latex emulsion seal coat was done in Portage County. Forty-three miles were treated in 1960 using MC-5 asphalt and 35 gals. of the rubber additive per 1000 gals. of asphalt. The rubber compound was poured directly into the distributor and circulated with the asphalt for about 20 minutes while the mixture temperature was increased about 50 degrees above the standard for the asphalt alone. Application was made at 300°F. Results of this work indicated that the rubberized asphalt is easy to handle, holds the aggregate readily, does not bleed, wears well and offers a possible savings by reducing the quantities of asphalt and aggregate required. In addition to the Portage County work, two other Ohio counties have done seal coating and ten Ohio counties are constructing sections of rubberized asphalt plant mix pavements.

"A Report on Use of Rubber Compounds in Asphalt Mixes." By Paul Shafer, Portage County (Ohio) Engineer and W. H. Metzler, Wayne County (Ohio) Engineer. *Better Roads*, August, 1961.

Raised Curb Reflectors

The problem investigated was how to make the edge of the paved surface of ordinary roads without hard shoulders and with raised curbs more visible at night in headlights. The devices tested were reflecting curbs, reflecting road studs and reflectors on posts. Concrete curbs are made more conspicuous (especially in the wet) by the provision of concrete facets set at right angles to headlight beams. Small deposits of mud have little effect, but normally if such curbs are to remain effective throughout the year, the large deposits that accumulate during the winter months would have to be brushed off. Even

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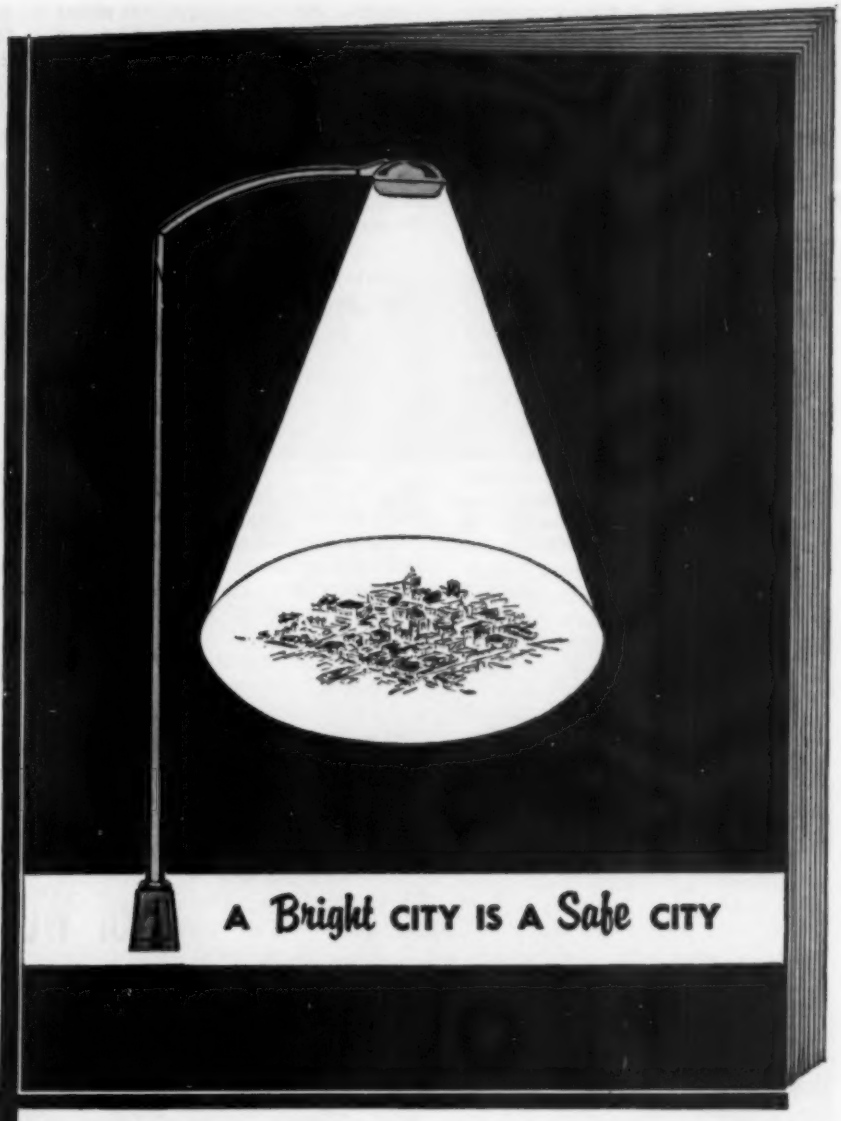
STREET LIGHTING PROGRAMS



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when clean, such curbs are of little assistance in thick fog. Any reflective marking, to be effective in thick fog, must incorporate an efficient reflex reflector. Reflex reflectors set in the curb are particularly vulnerable to mud splash and require frequent cleaning in winter. The mud deposited on them contains an oily component which is not washed away by rain. Several methods of using the familiar self-wiping reflecting road stud have been considered. If installed in the channel, they become clogged with mud; if moved further into the pavement they might prove dangerous to cyclists; if installed on the rising faces of the curb they are damaged by vehicles; if installed on the top faces vehicles do not run over and the wiping mechanism is inoperative, but they could be actuated by the road cleaner. Reflex reflectors on posts are less affected by mud splash than similar reflectors in the curb. Raising the reflectors and moving them away from the paved surface reduces the necessary frequency of cleaning but in these positions the reflectors are less strongly illuminated by headlights and give a less clear indication of the position of the curb. A reasonable compromise seems to be to have the reflectors at about the same height as headlights.

"Reflectors on Roads with Raised Kerbs." By A. W. Christie, Road Research Laboratory. *Traffic Engineering & Control* (London, England), July, 1961.

Erosion Test for Soils

To determine in the laboratory how much erosion will take place on a hillside fill, for given storm conditions, an apparatus allows the user to determine erosional rates for a given soil as affected by: relative compaction of the soil, slope of the hillside, rate and duration of water flow. Erosive medium for the experiment is sheet run-off, but the apparatus could be modified to introduce the action of raindrops. Erosion is measured on a weight basis and calculated as a percentage of the original dry weight of the soil sample. The test is only an approximation of field conditions, and the results are qualitative rather than quantitative.

"An Erosion Test for Soils." By Anton L. Inderbitzen, Engineering Geologist, Lockheed Aircraft Corp., Burbank, California. *Materials Research & Standards*, July, 1961.

Other Articles

"How Detroit Solves *Urban Transportation* Problems." Cooperative efforts of city, county, state and Federal agencies have provided the modern expressway system serving Detroit. By Glenn C. Richards, Commissioner of Public Works, Detroit, Mich. PUBLIC WORKS, September, 1961.

"Ohio's Short Course on Roadside Development." An annual forum that contributes to the rapid growth of roadside development technology. By W. J. Garmhausen, Chief Landscape Architect, Ohio Department of Highways. PUBLIC WORKS, September, 1961.

"Properties of *Asphalt Cements* Manufactured in Texas." Investigations are in progress on representative asphalts manufactured in Texas and used by the Texas Highway Department. The purposes of these studies are to: 1) Determine how binders can best be classified to qualify under handling and service conditions; 2) establish specifications to assure use of superior asphalts by the Department; and 3) determine how the durability of paving asphalts can be improved. By Dr. R. N. Traxler, Research Engineer, Texas Transportation Institute. Texas Highways, August, 1961.

"Construction of a *Lime Stabilized Base*." How a test section was used to reconstruct a residential street. By W. T. Winning, Jr., Street Supervisor, City of Webster Groves, Missouri. PUBLIC WORKS, September, 1961.

"Uses of *Epoxy Resins*." Characteristics and applications of these important engineering materials. By W. L. Minarik, Technical Director, Resiweld Division, H. B. Fuller Co., St. Paul, Minn. PUBLIC WORKS, September, 1961.

"Maryland's *Snow Control* Program." Careful planning, good communications, use of chemicals and adequate equipment all contribute to this program. By W. F. Hallstead. PUBLIC WORKS, September, 1961.

"How a Small County Maintains and Controls its *Maintenance Equipment*." By George A. Anderson, Highway Engineer, Sibley County, Minn. *Construction Equipment, Operation and Maintenance*, January-February, 1961.

"Minneapolis Installs New *Traffic Control* System." Careful planning, good communications, use of chemicals and adequate equipment all contribute to this program. By David R. Koski, Assistant Traffic Engineer, Minneapolis, Minn. PUBLIC WORKS, September, 1961.

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EMULSIFIED ASPHALT *PLANTS AND PROCESSES*

Thruway Prepares for Winter Storms

ROBERT DYMENT

Technical Writer

THE NEW YORK State Thruway Authority, determined to keep the 559-mile superhighway operating normally throughout the winter placed in operation during the 1960-61 winter emergency equipment to supplement its snow-fighting force of 600 men and 415 vehicles. Additional procedures were developed to warn motorists of bad weather and to keep the cross-state highway operating when other roads are blocked by blizzards.

New equipment included cots and blankets for motorists' use during emergencies if they are delayed at service areas, emergency food supplies, snowshoes for troopers and jumper cables to start cars with dead batteries. The Thruway Authority also lined up snowmobiles and helicopters to be borrowed or rented during an emergency.

Two weather services supply forecasts and advisory notice of conditions, giving the Authority a chance to move reinforcements into threatened areas. One is the Northeast Weather Service of Lexington, Mass., which helps pinpoint areas where trouble may develop. The other is a teletype system operated by the U. S. Weather Bureau and the New York Telephone Company to supply up-to-date weather information to the Thruway and other turnpikes, highway departments, auto clubs, radio and television stations and others concerned with weather developments.

Information of roadway conditions developing or existing is given to Thruway patrons on bulletin boards maintained at service areas and toll booths along the route. The bulletin boards also are used to advise motorists of the areas where lower speeds should be observed. As an additional safeguard for Thruway patrons heading into a storm area, state police shunt all cars into the service area just before the last interchange ahead of the developing storm, when conditions warrant. There, troopers will advise drivers that conditions are bad ahead and suggest that the travelers either remain in the service area or exit at the next interchange.

A thousand folding canvas cots, along with an equal number of paper-fibre disposable blankets, have been made available through the cooperation of the State Civil Defense Commission. Fifty are being stored at each of the big Class A restaurants, 30 at the medium-sized Class B restaurants and 20 at the Class C's. The rest are being kept at the maintenance areas for worker's use during extended storm duty.

Swift attention is given to motorists stranded in their cars. Troopers and Thruway personnel are prepared to distribute coffee and doughnuts for stranded motorists during an emergency. Crossovers between the east and west lanes are plowed immediately so that gasoline station and garage service trucks can reach disabled vehicles fester.

Special storm speed limits are posted at the bulletin boards at all Thruway interchanges. The practice of posting 25 or 35 mile an hour limits on the regular speed signs on the Thruway was discontinued because employes lost valuable time posting the special limit signs along the route—signs which then often became obscured by driven snow.

The New York State Thruway Authority is continuing its program of studies to make sure that this modern, safe superhighway can always merit such a claim. □□□

● **EMERGENCY equipment was added last winter to the 415 vehicles and 600 men engaged in keeping the New York Thruway open for traffic despite the heavy snow.**

● **IN DEEP cuts snow was packed against the side by the plowing equipment. Here a special unit is shown loosening this packed snow in preparation for another storm.**

Texas Interstate 35E, Stemmons Freeway out of Dallas.

Texas' 352 miles of Interstate awarded to CONCRETE promise big savings in upkeep!

Across Texas, modern concrete highways grow in length—a public reminder of the skills and dedication of the engineers and builders who are creating them.

A solid future is built right into roads like these. Only concrete enables engineers to design pavements to last 50 years and more.

Concrete isn't flexible, so there are no "moving parts" in it to cause hidden wear. And even with the highest temperatures, it won't soften and ripple under traffic. Concrete actually grows stronger year by year.

All these advantages mean extra thrift for Texas as it builds with concrete: Exceptional pavement life . . . upkeep costs that run far less than for asphalt. It's for reasons like these that most Interstate mileage across the nation today is going to concrete.

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38% maintenance saving with concrete, Texas' 31-year records show!

Official Texas State Highway Department records give the facts: Since 1929, road maintenance costs per mile per year for concrete have averaged $144.68; for asphalt, $235.23. Texas' new concrete highways will do even better!

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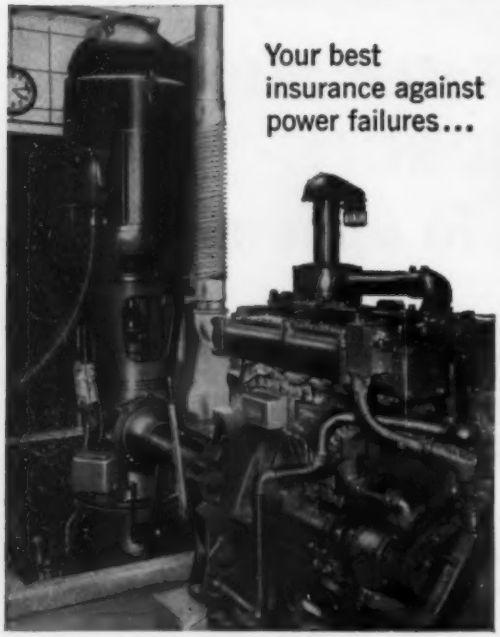

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Guidelines for Municipal Control of Family Swimming Pools

The New Jersey Public Health News has published a report of its committee on Family Swimming Pools. This article is slightly condensed from that report.

PROPERLY DESIGNED, properly constructed, and properly operated family swimming pools should be considered health assets. The design and construction of family pools are matters for municipal regulation, just as any building or plumbing construction. It is therefore suggested that municipal measures provide for the issuance of permits prior to the construction or installation of family swimming pools. However, controlling the operation of family pools by regulation is not generally recommended.

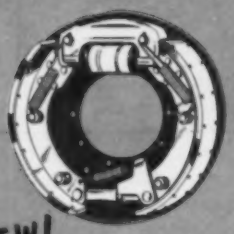
Since methods of administration and degree of needs vary, it is not deemed necessary to prepare a model ordinance or code for municipal use. Instead, the principles that follow may be considered as criteria or guides by those anticipating the preparation of a family pool ordinance.

Such an ordinance should be as brief and uncomplicated as possible, and should include matters relating to zoning, water supply, drainage, plumbing, safety, construction materials, filtration equipment and disinfection apparatus. Requiring family pools to meet certain operating standards appears highly questionable from both legal and administrative standpoints.

A realistic, reasonable, and practicable ordinance might incorporate, where applicable, the following suggestions:

1. *Enactment*: Any control measure should be promulgated by means of a municipal ordinance. This is desirable because of the limitations of the powers of boards of health with respect to private pool installations. In addition, other municipal agencies will have certain interests or responsibilities within the framework of such an ordinance.

2. *Administration*: Responsibility for the administration of such an ordinance should be vested within the building department or similar department responsible for the issuance of building permits with



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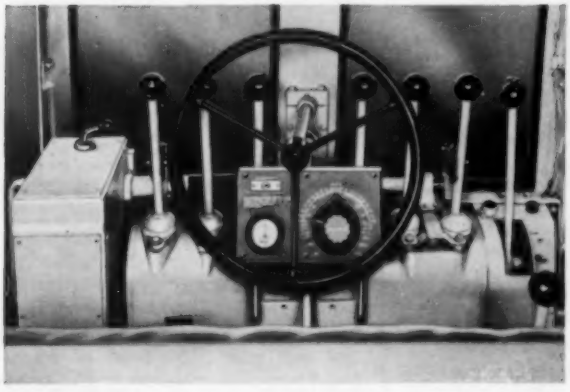

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Super-strong one-piece frame, for rigid support, trouble-free performance.

Full-floating drive axles and anti-friction power train for more usable power, less wear, less maintenance.

Welded bar-and-plate front axle (strongest in the industry!), *arched* to give up to 28" ground clearance.

Big blade-circle, 63" diameter for steady blade control.

Full-sweep visibility, operator can see all critical areas of blade, plus road ahead . . . sitting or standing. He also has "handy-reach" power controls.

Easy moldboard tilt adjustment, operator can tilt blade-angle in seconds.

Rubber-mounted engine, to minimize vibration.

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such issuance subject to the approval by the zoning board, health department, engineering department, water department or other appropriate municipal agency or department.

3. *Inspections*: Routine inspection of family swimming pools is not considered a public health responsibility.

4. *Enforcement*: The ordinance should provide the necessary authority to secure the abatement of any nuisance or health hazard existing at a family pool.

5. *Exceptions*: Small wading and temporary or callapsible-type pools of less than 750 gallons need little public health supervision. Their control, either by ordinance or regular inspection, is not required.

6. *General Provisions*: The general provisions included in a pool ordinance, such as definitions, fees, administrative procedures, penalties, etc., would be dependent upon the particular municipal policies, conditions and experience. Care should be taken to assure that the following basic criteria receive careful consideration: a) Location: The ordinance should contain minimum setback distances from dwellings, property lines, public roads, etc. In addition, rear yard-pool area percentage requirements are suggested. b) Nuisances: Control measures should be included to guarantee to adjacent neighbors that excessive noise or improper lighting facilities will not result in the annoyance or disturbance of the neighbors' comfort. c) Safety: In order to discourage trespassers and to provide safety measures, fencing requirements, including locking of entrance ways, are strongly recommended. d) Construction Materials: Family pools should be constructed of material that is durable, water proof, and easily cleaned. e) Water Supply: Water used for filling or make-up purposes should be of drinking water quality. Consideration might be given in municipalities that have actual or even potential water supply problems to prohibiting or discouraging the fill-and-draw type of pool. f) Drainage: An adequate discharge system must be provided wherein the pool water and filter-backwash water may be disposed of in a manner not to cause flooding of adjacent properties, municipal or private sewerage and water supply facilities. g) Plumbing: All plumbing work should be in accordance with the municipal plumbing ordinance. In addition, there should be control and inspection to prevent cross-connections. h) Circulation and Disinfection: It is suggested that where family swimming pools are contemplated having capacities in excess of 750 gallons, properly designed and constructed pumps, filters, and disinfecting equipment be required.

• • •

Equipment Purchases by Water Departments

In a questionnaire sent to engineers and superintendents in charge of water departments, the question was asked: How much does your department spend for new or replacement equipment each year, on the average, not including material (pipe, hydrants, etc.)? About 75 percent of the first group of cities replying to the questionnaire furnished reliable data. Equipment expenditure data were received from 47 states and the District of Columbia, 459 cities in all.

Total equipment expenditures were reported as $6,196,400 by these 459 cities, averaging $13,500 per city per year. The kind of equipment was not specified in the question, but other questions and replies indicated that purchases included motor trucks; automobiles;

(Turn to page 182)

sure cure for Mysophobia*

*mysophobia (my" so-pho' bi-a) *n. Pathol.* 1. dread of dirt. Common among public works officials charged with good housekeeping in municipal parking lots, garages, on sidewalks around civic centers and parks, in sports areas, equipment yards, warehouses—wherever large Wayne *street* sweepers can't operate. Attempts to use old-fashioned pushbroom methods and costly manpower only aggravate condition. Cure invariably effected with Wayne *Power* Sweeper of proper size. Ease of operation, large hopper capacity, job to job portability, and savings in manpower and time, *plus improved civic cleanliness* with a Wayne have great calming effect. Prescription without charge obtained by writing direct to Wayne. Distribution, parts and service everywhere.

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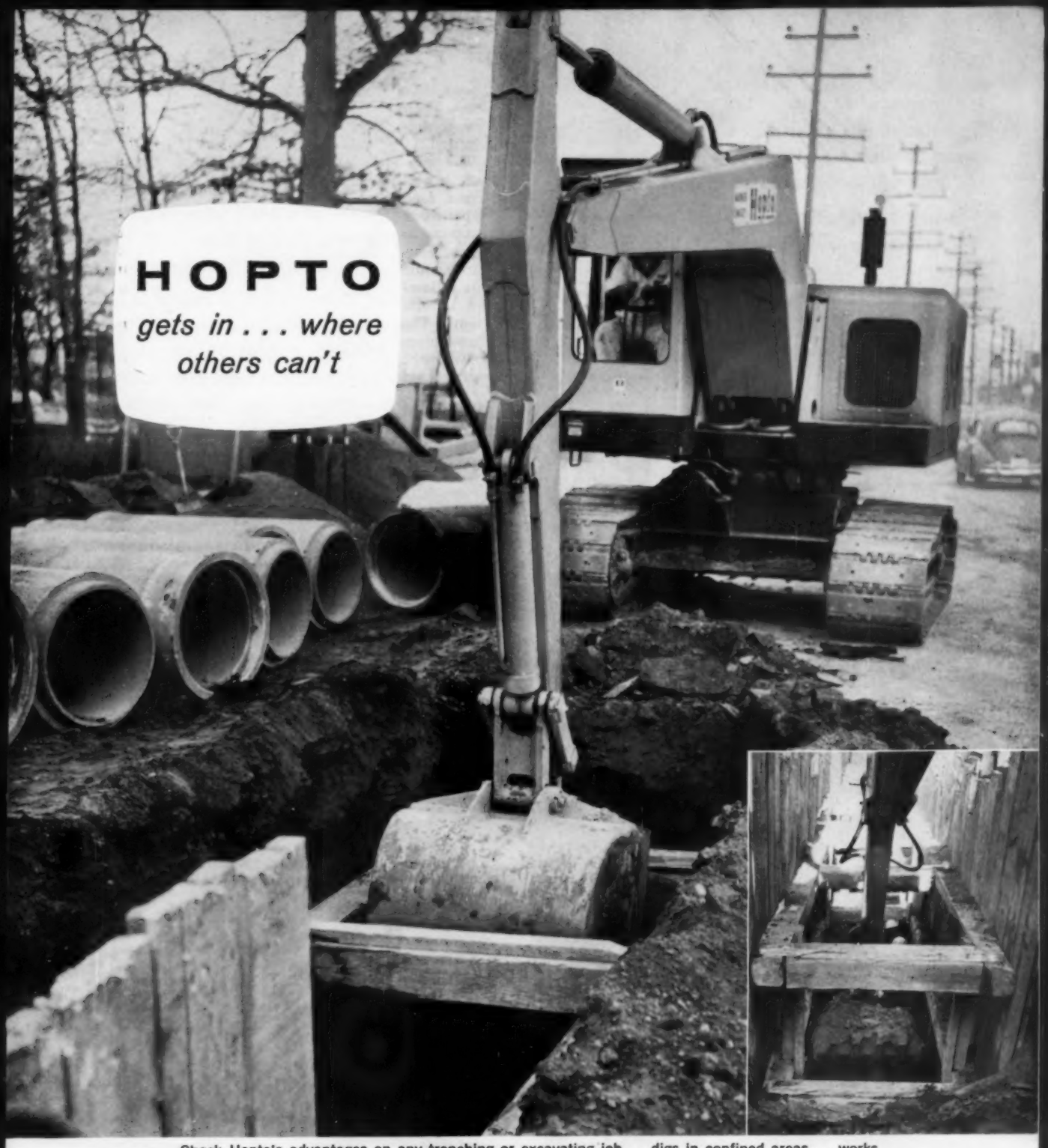

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It's good business to build streets that last. First, if Federal or State aid pays initial cost, maintenance costs are up to you. Second, tax dollars don't stretch very far if maintenance costs are excessive. Third, maintenance costs are high unless you reinforce your pavement the most economical way: with USS American Welded Wire Fabric.

USS American Welded Wire Fabric delivers the tensile strength needed to control cracks due to variations in temperature, moisture, soil shifting and traffic loads. It distributes balanced design that protects edges and corners. By actual measurement, welded wire fabric's ability to control cracks adds 30% to the strength of the slab.

USS American Welded Wire Fabric is precision-made of cold-drawn, 60,000 psi min. yield strength wire, sized to your exact requirements, ready for immediate placement. For full information, write American Steel and Wire, Dept. 1287, Rockefeller Building, Cleveland 13, Ohio.

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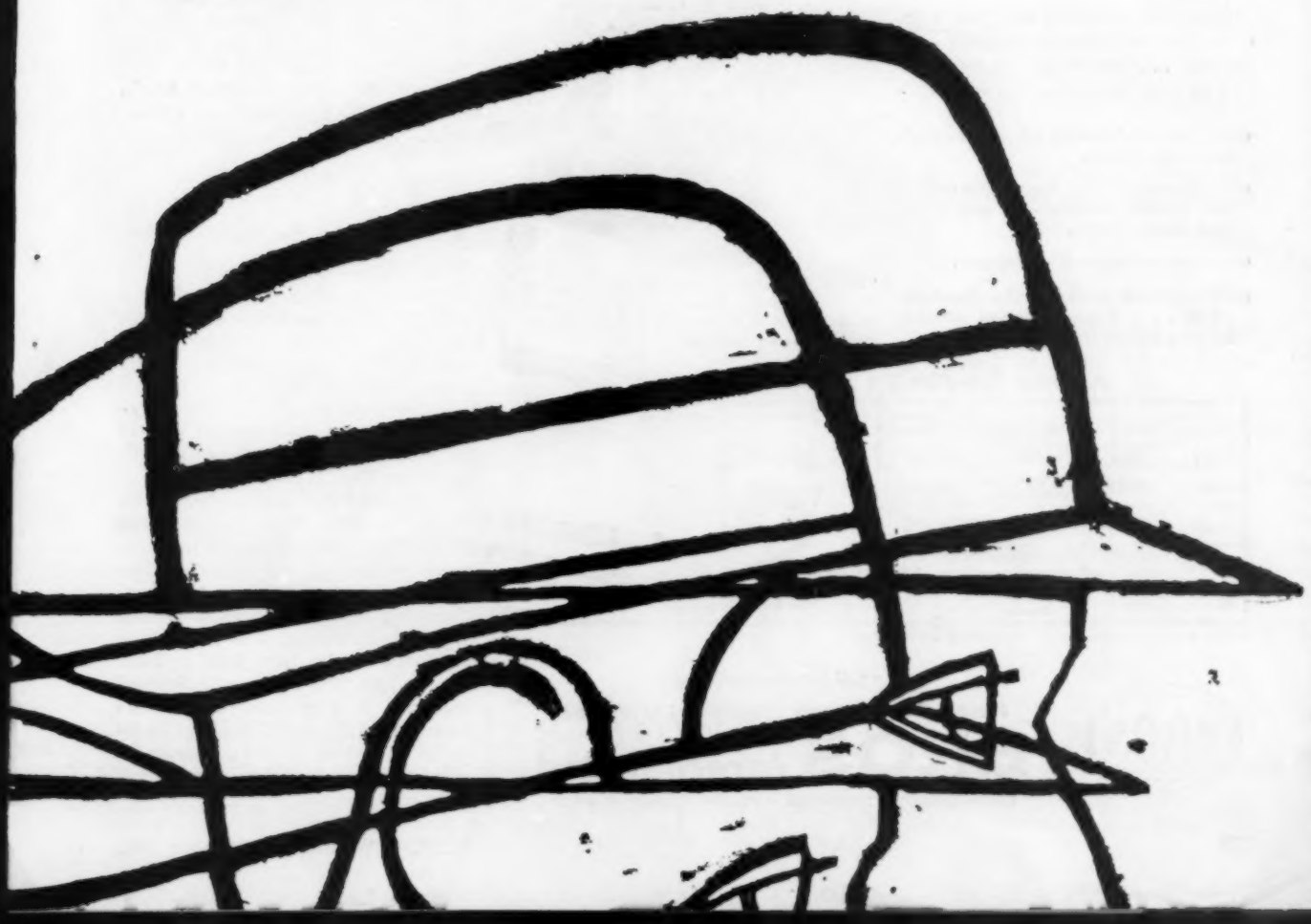

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Just mount a BROS Rotary *Sno-Flyr* on your present equipment and you're ready for the heaviest snowfall . . . *for no snow is too heavy for a* BROS.

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- **For knocking down high drifts which you couldn't handle with any other type of equipment.**
- **For casting snow from bridges.**
- **For efficient removal of extra-deep snow . . . or any removal without leaving ridges or banks.**

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MODEL	HP*	Mounts on:	Cutting Height	Cutting Width	Casting Distance**	Rotation of Casting Chute	Tons of snow per minute**
A-66J	36	Jeep	30"	6'6"	up to 40'	180°	up to 7
A-66CW	36	Jeep or other 4-wheel drive vehicle	30"	6'6"	up to 40'	220°	up to 7
A-66L	36 or 61	Front end shovel or loader	30"	6'6"	up to 40'	180°	up to 7
A-76CW	61 or 107	2-ton and larger trucks with universal type hitch	30"	7'6"	up to 40'	320°	up to 15
BL	168	Front end shovel or loader	40"	8'	up to 75'	320°	up to 20

* Hp ratings are dynamic bhp **Depending on horsepower

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air compressors; backhoes, shovels and other trenching equipment; front end loaders; wheel tractors; and probably pumps for dewatering trenches and other excavations and portable generators.

The smallest equipment expenditures reported were from Arkansas, Georgia, Idaho, Indiana, Maine, Maryland, Mississippi, North Dakota, South Dakota, Utah, Vermont and West Virginia. The averages from each of these states was less than $6,000 per city per year.

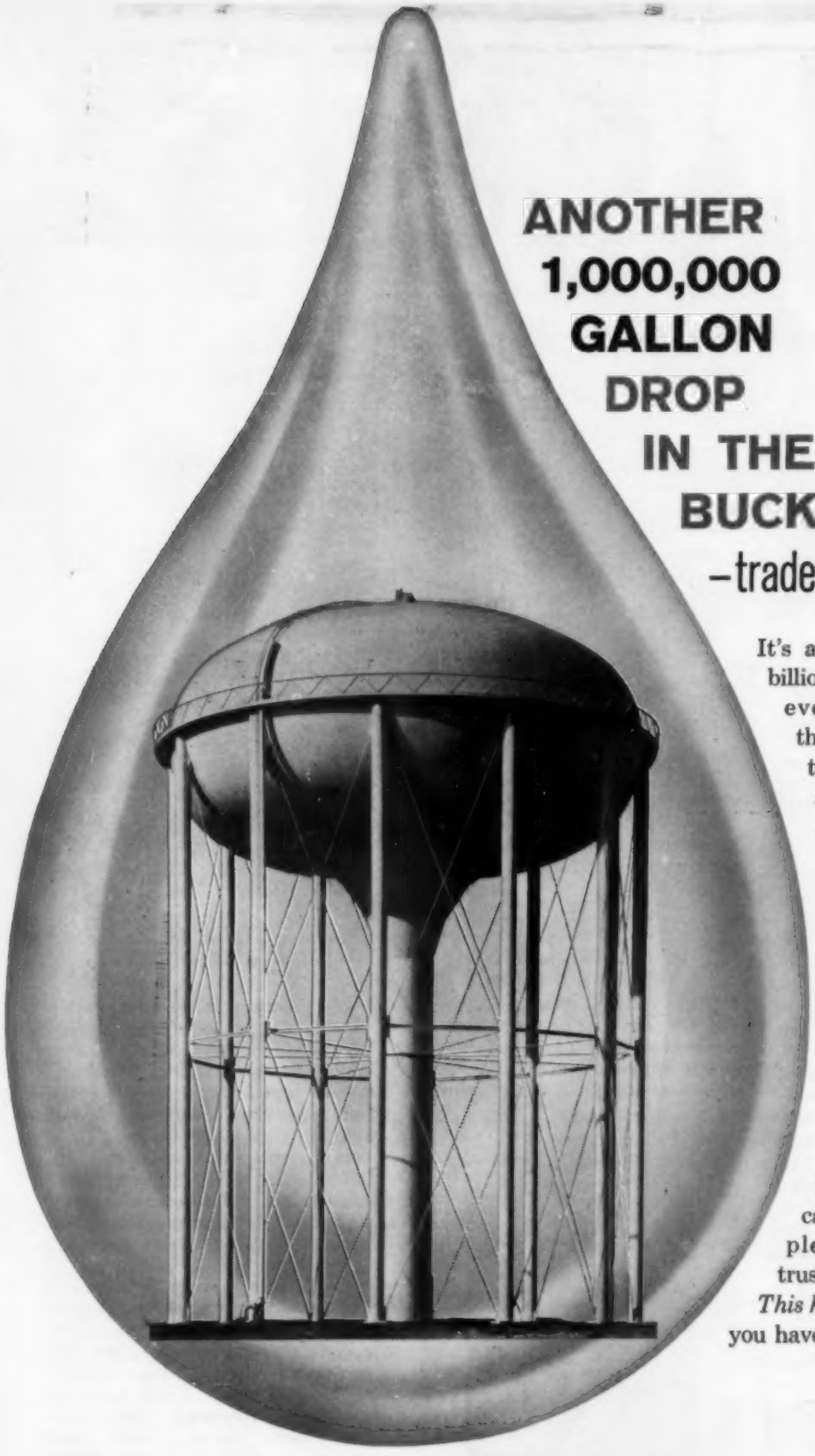
In studying national performances, the Editors have selected five states as being conservatively representative of all. These five states are Alabama, Iowa, Minnesota, Ohio and Washington, representing typical sections of the country. From these five states, 77 cities reported total annual average expenditures of $1,178,900 for equipment. This is an average of $15,310 per city and is more than 10 percent above the nationwide average. However, this group of states, in this case was perhaps overbalanced by the returns from Minnesota where 15 cities reported equipment expenditures of more than $25,000 each per year. If Minnesota is excluded, the remaining 62 cities from four states were almost precisely at the nationwide average. It appears, however, that these five states are more typical of the national average in county and state highway work, and perhaps in city engineering work, than in water department operations.

• • •

Plastic Linings for Water Tanks

REDWOOD water storage tanks with capacities of up to 100,000 gallons have been lined with Koroseal polyvinyl plastic to stop water seepage. The loss of water, unsightly water stains and the cost of repeated painting prompted officials of several California municipalities to correct the leakage problem in this manner.

Linings for each tank, supplied by Globe Linings, Inc., Long Beach, California, were fabricated into one piece from Koroseal polyvinyl hydraulic lining materials manufactured by B. F. Goodrich Industrial Products Company. The plastic linings vary in size from 2,000 to 3,000 square feet. The Koroseal polyvinyl material is gray color and 0.012-inch thick. All seams are electronically welded to form a permanently watertight bag that fits the full contour of the tank.



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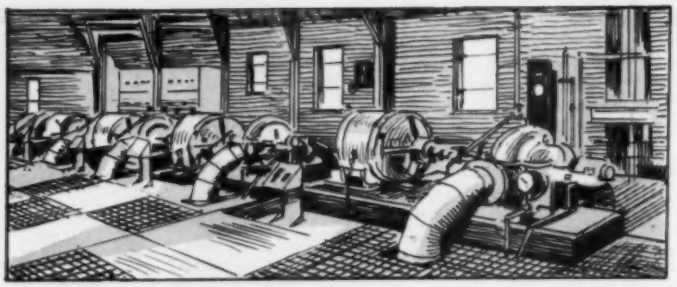


Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Distribution

System Losses

In this first installment of a series of articles on water quantity accounting, the author outlines the problem, discusses the utility system generally and the utility distribution system specifically. An analysis of the factors which contribute to water losses in the distribution system are treated in some detail. This loss is a needless waste of chemicals, electric power, and labor that adds nothing to economic growth. In fact, profitable operation of a water system is directly related to prevention of water loss and improvement of efficiency of operation. National distribution system loss has been estimated at $50 million per year and is therefore well worth studying and correcting. Wherever possible, distribution system leaks should be located and repaired, thereby reducing the load and extend the life of the water facility, which includes all transmission and distribution pipe lines with the necessary valves, fire hydrants, ground storage tanks, reservoirs, elevated tanks, standpipes, booster pumps, service pipe and meters. It has been estimated that correctible leakage for the 13,000 public water systems serving 85 million people amounts to 4,000 million gallons per day. As an example, the City of Chicago, between 1930 and 1945, had an outstandingly successful leakage control program which resulted in an increase in the annual gross billings, while at the same time the annual average pumpage was decreasing. The achievements of this program may be summarized as follows: 1) Lower daily average pumpage with higher delivery pressure; 2) lower cost of operation through savings in coal and power cost; extended life of pumps, boilers and motors; lower cost of maintenance; 3) lower maximum hour demand with greater improved delivery pressure at high demand hours; 4) postponement of plant construction; 5) meeting all requirements for water during World War II without increasing the water supply plant.

"Water Utility Distribution Loss." Part I. By Dale Smelzer. Knoxville, Tenn. *Water & Sewage Works*, August, 1961.

Drinking Water Standards, 1961

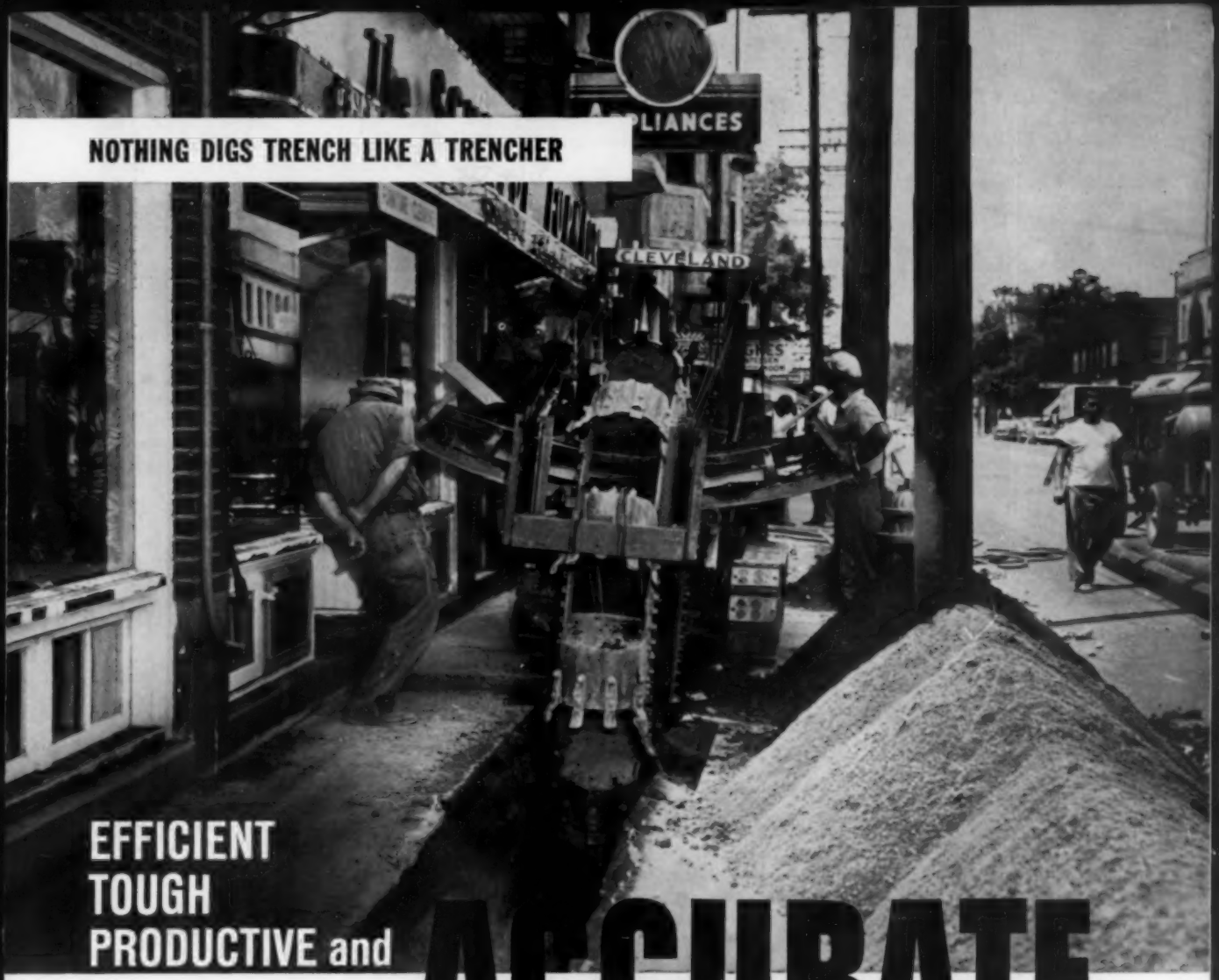
The Advisory Committee on Revision of the USPHS 1946 Drinking Water Standards has submitted its report which has been approved by the Secretary, HEW, and published in the Federal Register. The committee has taken cognizance of the growing problem of potentially harmful chemicals in sources of drinking water. Limits for several new chemicals have been added, including a gross limit for the concentration of some types of synthetic chemicals. It was not feasible to include limits for all the many chemicals that have varying degrees of potential toxicity but consideration was given to the more common chlorinated hydrocarbon and organophosphate insecticides; however, specific limits for these chemicals were not established because of insufficient epidemiologic and toxicologic information. This revision of the drinking water standards

Ultrasonic Cleaning System for Water Meters

ULTRASONIC cleaning systems are now being employed to clean water meters more effectively, and in half the time previously required at the Southern California Water Company. After a test period which indicated substantial economies and increased production capabilities, the company purchased and is now operating a standard 10-gallon-capacity ultrasonic cleaner built by General Ultrasonics Division of Acoustica Associations, Inc., Los Angeles. Utilization of the system has nearly doubled the capacity of the utility's meter department while eliminating a hazardous acid bath method formerly used.

● **LABORATORY demonstration shows how ultrasonic bath loosens the dirt.**

The cleaning system consists of a 1,000-watt fully-transistorized generator in combination with a 10-gallon transducerized tank. The meters are cleaned in a few seconds by high frequency sound waves in the 20-kilocycle range. Upon activation, these sound waves flash through an ordinary aqueous cleaning solution in the tank, resulting in a powerful scrubbing and cleaning action. An average of 70 meters are cleaned each day.



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includes, for the first time, limiting concentrations of radioactivity in water. The limits presented are an effort to derive conservative values from the best information now available and may be adjusted upward as new and better data become available. The committee recommends that a mechanism be established for continual appraisal and appropriate revision of the standards and that the USPHS intensify its continuing studies toward the development of basic information on the relationship of the biochemical, chemical, physical and radiological aspects of water quality to health in this increasingly complex technological environment in which we live.

"Drinking Water Standards, 1961." A report of the Advisory Committee on Revision of USPHS 1946 Drinking Water Standards. *Journal AWWA*, August, 1961.

Zeta Potential

The Zeta potential (ZP) is a measure of the electrokinetic charge (expressed in millivolts) that surrounds suspended particulate matter. Raw water turbidity usually has an electronegative charge sufficiently strong to result in significant mutual repulsion. If the charge on these particles is reduced to zero, these repulsive forces are eliminated. Agglomeration will usually result with gentle mechanical agitation of water treated in this manner. Colloid particles with diameters ranging from one thousandth to one millionth part of a millimeter and electronegative Zeta potentials in the range of 15-25 mv are difficult to agglomerate. As conventional alum or ferric floc is also electronegative in about this same millivolt range, a mutual repulsion exists between the floc particles and the colloids, and these repelling forces prevent the colloid from making permanent contact with the floc, regardless of agitation. Raw water colloids can be effectively removed only by lowering the ZP of both the floc and the colloid to a value of approximately zero plus or minus about 5 mv. This can be accomplished by simultaneously employing the proper dosage of an inorganic coagulant and an appropriate organic polyelectrolyte as has been done at the Waterford, N.Y., water treatment plant since July, 1960, using the Hudson River as the source of supply. Zeta potential measurements are made each morning of the raw water colloids and floc from the first flocculation bay. Chemical dosages, ie, alum-calcite and a cationic polyelectrolyte are adjusted accordingly. Flocculation has remained excellent, even during the winter months, and the effluent is clear and sparkling. In addition taste and odor removal has been excellent. An incidental benefit has been a considerably higher reduction (99.9%) of the raw water coliform organisms than can be effected with conventional coagulation. The author has included several figures in this excellent article which will aid the reader in a bettter understanding of this important subject.

"Zeta Potential and Its Application to Difficult Waters." By Thomas M. Riddick, Thomas M. Riddick & Associates, Cons. Engrs. & Chemists, New York, N.Y. *Journal AWWA*, August, 1961.

Algae Control with Copper Sulfate

The City of Richmond, Va., water treatment plant, controls algae through the addition of copper sulfate at the influent of each settling basin. In addition, copper sulfate is added to the finished water imme-

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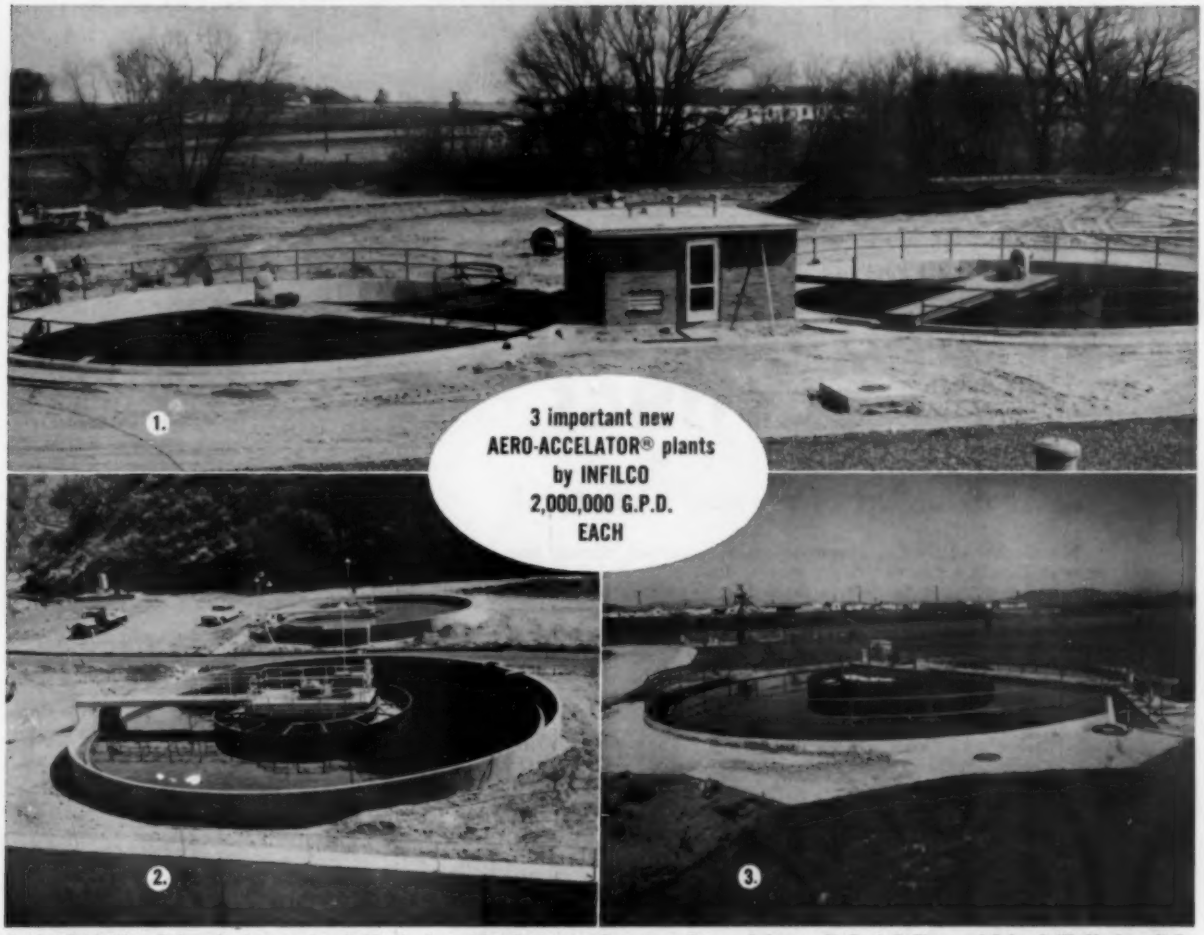

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diately after filtration and before aeration. As a result of numerous examinations for algal growth in the reservoir, elevated storage tanks and distribution system, it was found that a copper residual of 0.10 to 0.15 ppm in the finished water at the filter plant was sufficient to retard algal propagation during the colder months of the year and that from 0.15 to 0.20 ppm would be required for the summer months. The amount of copper required for complete algal control is small and the cost is low when one considers the vast returns obtained through cleaner meters, distribution systems and reduction in bad water complaints.

"Two-Point Copper Sulfating Program Licks Algae Problem." By Willard W. Anders, Senior Chemical Engineer, Dept. of Public Utilities, Richmond, Va. *Water Works Engineering*, August, 1961.

Controlling Water Pressure

Due to the local topography in Portland, Oregon, it is imperative to install pressure regulators in many sections of the city to avoid excessive and damaging water pressures. The range in elevation in the City of Portland ranges from a high of 1,044 feet at Council Crest to a low of 24 feet above sea level. By the installation of 217 automatic pressure regulating valves at 105 installations, water pressure is being controlled effectively and at the least cost to the water user. These "regulators" vary in size from ¾ inch to 24 inches, maintaining a range in pressure suited to the needs of the area served, usually from 50 to 100 psi. One of the most widely used and most effective automatic regulating valves used in the Portland water system is the single-seated diaphragm-operated globe type valve. The regulators are generally installed in pairs but sometimes in threes where there is a wide variation in flow. Each regulator installed in parallel opens at a slightly varying pressure to prevent chatter on the valves.

"Controlling Water Pressure Over 1,000-Ft. Elevation Range." By H. Kenneth Anderson, Chief Engineer, Bureau of Water, Portland, Oregon. PUBLIC WORKS, September, 1961.

Shopping Facility Water Demands

In an attempt to consolidate water use data of shopping centers, supermarkets, motels, highway service and rest areas, and large suburban restaurants, the editors of PUBLIC WORKS wrote to all state health departments, selected county and city health departments, some water superintendents and turnpike organizations for all data available. From the considerable amount of information recieved the following examples are cited for purposes of this digest: In shopping centers in the Miami area the average water consumption varied from 143 gpd per 1,000 sq. ft. for a 98,500 sq. ft. store area to 210 gpd per 1,000 sq. ft. for a 500,000 sq. ft. store area. Maximum monthly consumption values ranged from 176 gpd per 1,000 sq. ft. to 306 gpd per 1,000 sq. ft. The usage contributed by large restaurants and cafeterias affected water consumption, with 33 to 67 gpd of the total per 1,000 sq. ft. attributed to them. In a 16,000 sq. ft. shopping center in Springfield, Mass., the high water consumption rate of 2,240 gpd per 1,000 sq. ft. was attributed to a self-service laundry. Other shopping centers in this area had water consumption somewhat lower than in the Miami area. Water consumption in supermarkets, based on observations at more than 60

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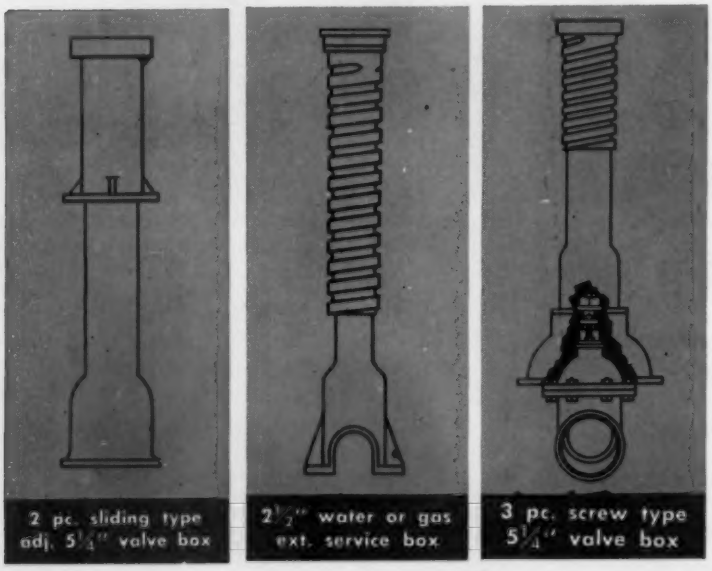

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3. Educational Program which the city government carries out, encouraging all home owners to install disposers. The city can also aid by helping to work out a finance plan.

For more information about how the General Electric Disposall can help your community, write: General Electric Company, Dishwasher and Disposall Department, Major Appliance Division, Louisville 1, Kentucky.

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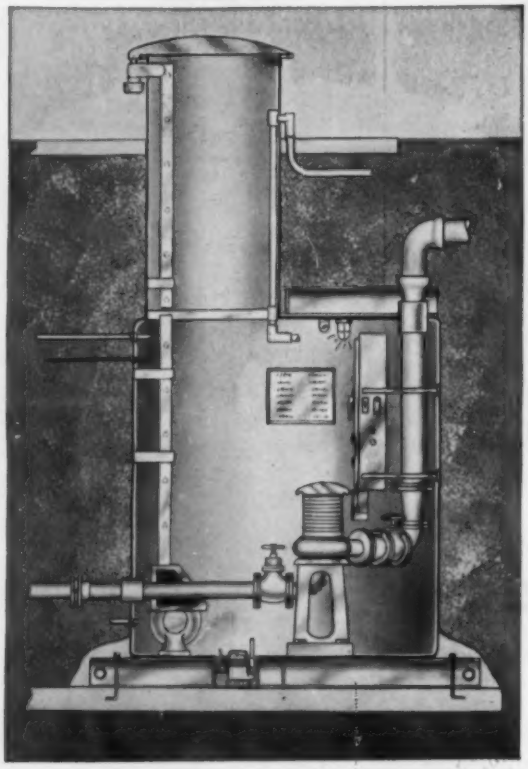

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establishments, varied from 24 to 3,370 gpd per 1,000 sq. ft. The higher value was at a supermarket in which there is no recirculation of the cooling water. The lower values were of supermarkets owned by the larger chains. Water consumption at motels varied from 50 gpd per housing unit in Pennsylvania (based on average flow) to 196 in Florida. The values for highway service and rest areas vary considerably depending upon: 1) number of service areas along the road; 2) the size of the service areas and 3) the high percentage of long distance travelers.

"Water Demands of Decentralized Community Facilities." PUBLIC WORKS, September, 1961.

Other Articles

"Detergents and Other Contaminants in Water Supplies—1960." An up-to-date discussion of this important problem. By James C. Vaughn, Chief Filtration Engineer, South District Filtration Plant, Chicago, Ill. Journal AWWA., August, 1961.

"Development of a **New Water District.**" Clifton, Colorado, purchases water from Grand Junction to supply an equivalent population of 4,000. By V. A. Vassen, President, Ripple & Howe, Inc., Consulting Engineers, Denver, Colorado. PUBLIC WORKS, September, 1961.

• • •

Giant Traveling Grate Stokers

New York's new Hamilton Avenue Incinerator Plant, recently constructed in Brooklyn at a cost of some $5,000,000, installed four giant traveling grate stokers capable of consuming 1,000 tons of refuse every 24 hours.

Each of the four units consists of a drying stoker and a burning stoker eight feet wide. The 22-foot long drying stoker is placed at a 25° angle to expedite the automatic feed. The burning stoker, 35 feet, 3 inches long, automatically discharges the incinerated residue.

The four stoker units were manufactured by Illinois Stoker Company of Alton, Illinois, and were custom-designed to fit the individual specifications of the Brooklyn plant.

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Transite speeds assembly, means a bigger day's return. And the J-M Ring-Tite joint is your assurance that the line will pass leakage or infiltration tests. You "button-up" the job faster when you use Transite Sewer Pipe.

...ON SUBSURFACE DRAINAGE JOBS

Transite Underdrain Pipe means savings wherever subsoils must be stabilized. This new perforated pipe means savings to contractors, for Transite's long lengths, fewer joints, low material cost all add up to more profitable jobs.

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Transite Ducts mean narrower, shallower trenches . . . crews attain faster laying. Transite comes in long 10′ lengths . . . joins quickly and securely with a J-M Plastic Coupling. Pneumatic rodding means additional savings!

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REO "C-SERIES" TRUCKS! Famous for economy under tough, stop-and-go operating conditions. Extremely short turning radius make them a cinch to maneuver in heavy city traffic and narrow side streets. Optional right hand drive available. **FOUR MODELS:** 18,500 to 31,000 GVW; 125- to 185-in. wheelbases; take 13 to 20 yd. refuse bodies. Powered by Reo's modern **GOLD COMET** engines (110, 130, 170, 185 h.p.) for more profitable payloads, minimum maintenance. *Gold Comet's* "wet sleeve" construction eliminates the need to re-bore cylinders or replace the block for the life of the truck. Available with fully proved, fully automatic **REOMATIC** transmission that eliminates gear shift guesswork, prevents engine lugging, minimizes chance of shock load damage.

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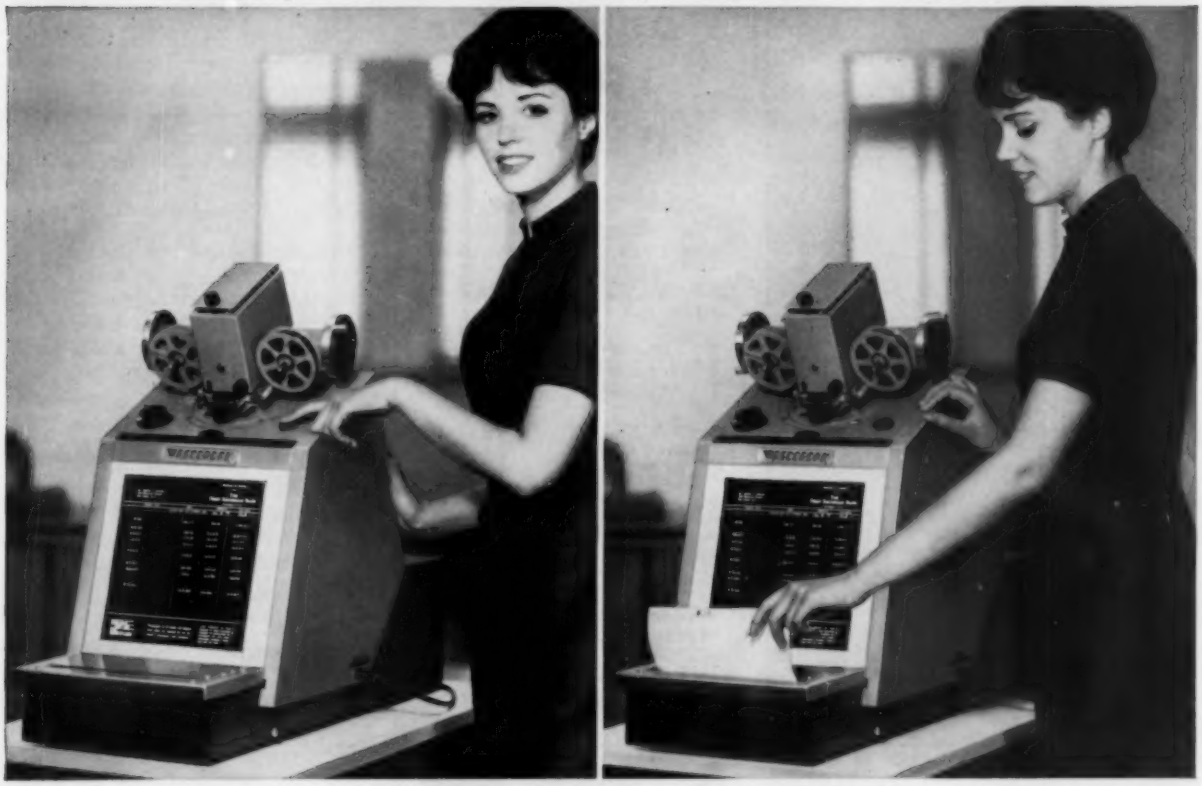

Announcing...

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For fast, convenient reference to microfilm and printmaking whenever needed

In seconds the versatile RECORDAK Reader-Printer gives you a sharp and photo-exact paper copy of any document on 16mm or 35mm microfilm, whether in roll form, acetate jacket, or aperture card.

Operation is completely automatic from the instant Print Button is pushed. Nothing further to do but pick up the trimmed, ready-to-use print of the projected microfilm image. Cost is about 9¢ for photographic paper and chemical used.

Special features of the new RECORDAK Reader-Printer add versatility to its speed and convenience. For example:

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- Full line of accessory lenses of magnifications between 11x and 34x—interchangeable in seconds—is available. The RECORDAK Reader-Printer comes equipped with one lens of your choice.
- *One-year service at no extra charge* . . . an important Recordak extra that's backed up by a skilled, nationwide service organization.

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- "PosiJector" prevents recirculation of solids, channels them into discharge flow.
- Non-clogging strainer passes sticks, leaves.
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- Suction chamber unbolts for quick inspection, adjustment, cleaning.
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THE JAEGER MACHINE CO.
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YOUR CHOICE OF 3 TELEMETERING SYSTEMS

Remote Supervisory Controls designed and manufactured by Healy-Ruff Company are easy to supply—simple to use. Control only, or recording and indicating as well can be supplied. All systems incorporate these desirable features:

- *Receiver can be any distance from mitter*
- *Only one pair of wires is required*
- *48 volt D.C. signal is used for lowest telephone line charges*
- *Heavy-duty mercury switches permit direct operation of motor starters*

The RTM provides multi-circuit control, up to 8 circuits over one pair of wires with single receiver. Transmitter can be pressure or float-operated. A D.C. signal in direct proportion to the pressure air level being sensed is transmitted, using proven time-impulse principle. Receiver can be furnished with recorder and indicator.

The Bi-trol controls two pumps over one pair of wires. First signal operates one pump—second signal operates other pump. An alternator can be supplied to equalize pump wear.

The Uni-trol controls a single pump. Type TAE is available with a return signal, to indicate the pump has started.

Write for Bulletins RTM and SC

HEALY-RUFF COMPANY

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First in dependable controls for waterworks and sewage—since 1929

Remote supervisory controls • Complete system controls • Elevated tank controls • Sump controls • Hydropneumatic tank controls • Float controls • Alternators • Alarm silencers • Protective devices

NEWS OF ENGINEERS

LEROY F. JOHNSON has retired as Maintenance Engineer of the New Hampshire Public Works and Highway Department after 46 years of distinguished service. He had served as maintenance engineer since 1934, probably longer than anyone else in a comparable position.

Organizational changes of L. Frederick Pack Associates of Hawaii, Ltd., are as follows: R. D. THOMAS, president and general manager; M. S. BOGOST, vice president and director; R. F. PEART, secretary-treasurer; and CHAS. YOON and M. C. DEASE, directors.

MARK D. STENSON, project engineer for the Washington Public Power Supply System, has joined the consulting engineering firm of R. W. Beck & Associates, Seattle, Wash.

FRED H. PUCKHABER, long-time district manager for Wallace & Tiernan Co. in Dallas, Tex., has become associated with Black & Veatch, consulting engineers of Kansas City, Mo. His headquarters will be in Dallas.

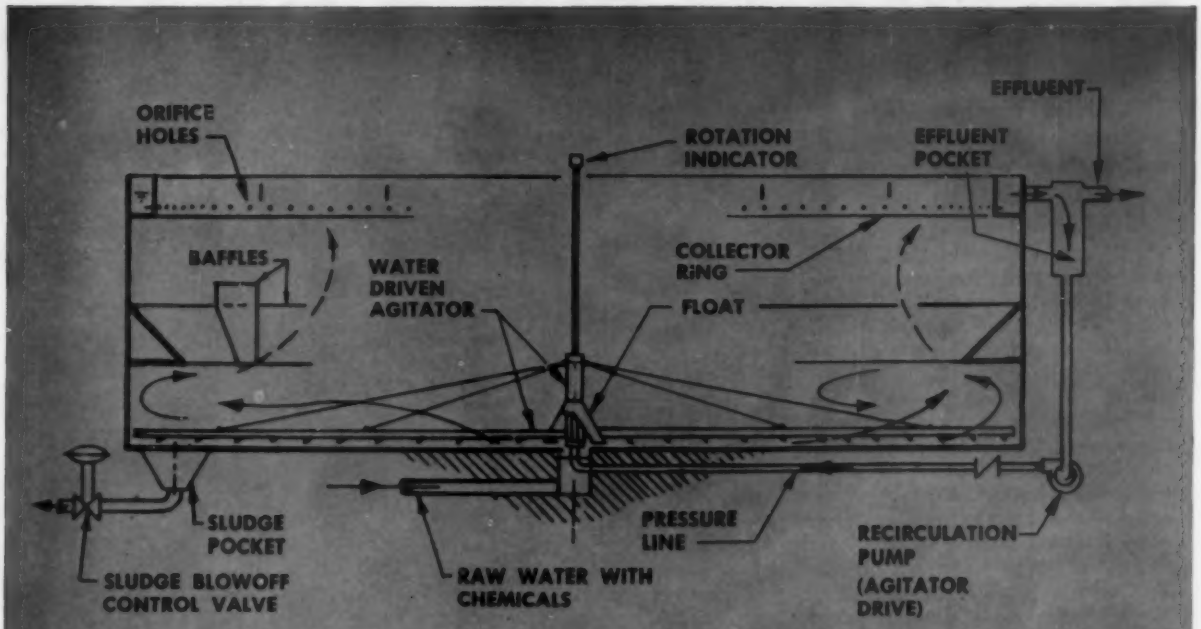
ALEX G. SUTTON, Jr., Colonel, Corps of Engineers, USA, is now Director of the Army Engineer Waterways Experiment Station in Vicksburg, Miss. He succeeds Col. EDMUND H. LANG, who goes to Korea.

J. E. LINDEN has been elected executive vice president of De Leuw, Cather & Co., consulting engineers of Chicago. He succeeds L. H. CATHER who will continue to serve as vice president and treasurer.

BRUCE L. CLIFFORD has been appointed director of Public Works for Rockport, Mass. He was previously assistant superintendent of Public Works of Darien, Conn.

MILTON ROSEN, Commissioner of Public Works of St. Paul, Minn., is the first recipient of honorary life membership in the St. Paul Junior Chamber of Commerce Golf Committee.

LOUIS G. PULS, chief designing engineer of the Bureau of Reclamation at Denver has retired after more than 30 years of service. He will enter practice as a consulting engineer.



Will this new precipitator change your thinking about costs, shock loads?

New Permutit Type M Precipitator ... a study in simplicity

Now in operation is this new precipitator for reducing turbidity and color in water.

We call it the Permutit Type M Precipitator. It is a study in simplicity, and because of its low construction and operating costs, it opens up new opportunities to obtain solids-contact clarification at minimum cost.

"Missing" parts: There is no motor-driven agitator on the Permutit Type M Precipitator. No extensive baffling. No center platform. No access walkway. All these have been done away with, because the unit has a new and different agitator system which sweeps away the settled sludge. Rotating agitator arms are supported by a "semi-buoyant" hub (or float) which revolves about a bearing post on the tank floor. Recycled effluent drives the agitator through jet nozzles located at the end of each arm. Smaller jets, spaced along the arms, gently nudge the settled sludge toward a sump at the outer rim of the tank floor.

Briefly, this is how the M unit works: raw water and chemicals are mixed in line and enter at the center of the tank floor beneath the conical rotor float which deflects the fluid mixture radially outward to the walls. A horizontal baffle on the tank wall then reverses the flow back toward the center thus imparting a rolling action to the sludge blanket. This current flow constantly places previously formed sludge in intimate mixture with the raw water immediately as it enters the tank. Clarified, effluent is collected by a flume at the top.

Agitator float and hub assembly.

Sudden water changes: An additional benefit of the Permutit Type M Precipitator is its exceptional ability to handle shock loads.

A case in point: red dye from a paper mill a mile upstream showed up one day in the raw water entering a Permutit Type M Precipitator in use in New England. But the unit went right on putting out an effluent with no significant change in quality.

So much interest has been shown in this new unit that we have reprinted the paper, "A Recent Development in Solids Contact Clarification Design", by E. D. Driscoll of Permutit. We'll be glad to send you a copy.

Write to Permutit Division, Dept. PW-101, 50 West 44th St., New York 36, New York. (In Canada, contact the Permutit Company of Canada, Toronto.)

PFAUDLER PERMUTIT INC.
Specialists in FLUIDICS... the science of fluid processes

New Concepts in School Zone Signs

ANDREW PLUMMER
Assistant to the Superintendent, Cook County Traffic Engineering Department, Chicago, Illinois

THE Cook County Traffic Engineering Department has developed two unique school zone signs —one portable, another with a folding face—to enforce a state amendment which requires 20-mile speed limits for school crossings in Illinois.

These new signs, surfaced with fluorescent plastic film, provide two significant advantages, versatility and visual impact. Portable types can be wheeled into place easily by pupil crossing guards and removed from the street when not in use. Folding faces on other signs cover the legend when it is not required. Impact is obtained by the bright fluorescent orange background of both signs which sets them apart from any other traffic control device, providing an unmistakable symbol for school crossings alone.

The portable signs are positioned in the middle of the street when children are present. Each sign has two wheels on its base for easy handling. We developed this wheeled type because it was evident few pupil crossing guards are strong enough to lift and carry these signs when they are mounted on a flat metal base. The base and post of each portable sign is coated with fluorescent paint. These portable signs are stationed 200 feet before each crossing. Their vertical legend reads "School—20 MPH."

Other signs are mounted on steel channel posts on the right shoulder of the street 600 feet before the crossing. They are hinged horizontally so crossing guards can fold the top half down over the lower half when the signs are not in use. A simple latch locks them in place at the top of the post.

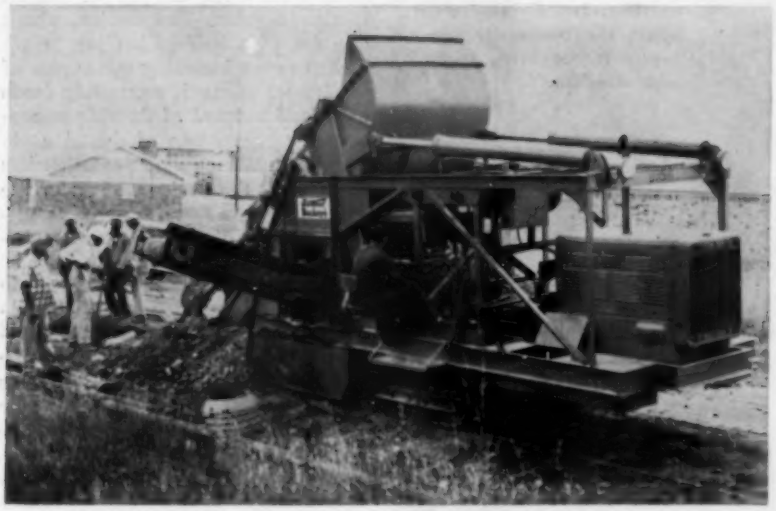
Fluorescent film is bonded to aluminum sign blanks before being silk-screen printed with black legends and borders in the county's Traffic Engineering sign shop in suburban LaGrange Park.

Both types first were used in the spring of 1960 to remind motorists of the reduced speed limits in school zones. Public reaction was instantaneous and favorable. School authorities favor the new signs because fluorescent orange distinguishes them from other regulatory signs.

● **ROADSIDE signs are hinged horizontally so the top half can be folded down to cover the lower half when not needed. Simple latch at top locks sign in place for use.**

● **PORTABLE signs are placed 200 ft. in advance of each school crossing, and in the middle of the street. Two wheels on base permit easy handling by guards or pupils.**

DALLAS PICKS GAR WOOD FOR MUNICIPAL DITCHING



DALLAS USES BUCKEYE 160 for high productivity. The machine features an adjustable telescopic boom with hydraulic down pressure, power-shift conveyor, and individual steering of each crawler. The 160 reverses for undercutting and tunneling.

BUCKEYE 407 GIVES DALLAS FAST, ECONOMICAL DITCHING

When Dallas needs maneuverability—for digging past above-ground and around underground obstructions—they turn to their Gar Wood-Buckeye 407. Several advanced features make the 407 today's most modern ladder-type utility ditcher. One is the live hydraulic boom hoist and crowd, instantly controlled by a single lever. Another is the conveyor, shifted electrically by pushbutton. A third is the Hi-Lo traction shift, that permits forward or reverse digging speeds to be instantly increased or reduced 50% without disengaging the main engine clutch.

Features like these—standard equipment on the 407—make Gar Wood-Buckeye the outstanding choice for municipal utility ditching.

Water Department Speeds Construction with 4 Buckeye Ditchers

In Dallas, Texas, more office buildings have been built since the War than any other U. S. city except New York. To keep pace with this boom, the city uses four ditchers for non-contracted work. All four are Gar Wood-Buckeyes.

The city alternates these machines in various types of terrain. A Buckeye 308, most advanced wheel-type ditcher on the market, is employed when the digging is through hard limestone rock. A Buckeye 407 is used for deep digging. Two Buckeye 106's are used for all-purpose ditching in all types of soil.

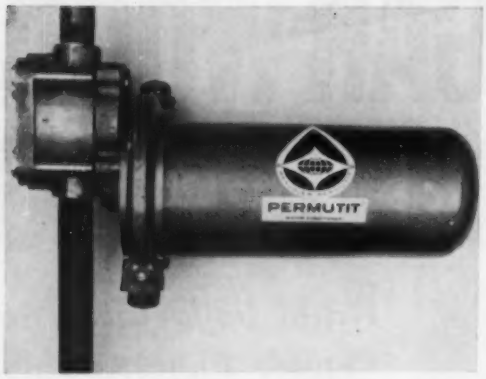
The success the City of Dallas has had with Gar Wood-Buckeye ditchers is typical of the high-production, low-maintenance performance these machines are giving municipalities across the country. For more than 60 years Gar Wood-Buckeye has led the field with design standards, engineering developments, and the finest service organization in the industry.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan

Findlay, Ohio

Home Fluoridation Unit



● **COMPACT device, the Permutit Home Fluoridator, is designed to bring benefits of fluoridation into areas where the community water supply is not being treated with fluorides.**

A SMALL tamper-proof device that makes fluoridation of water possible for individual families has been developed by Permutit Water Conditioning Inc., a subsidiary of Pfaudler Permutit, Inc., under a contract with the U. S. Public Health Service. The device, about the size of a half-gallon jar, is attached to the incoming water pipe of the home, where it accurately feeds the small amount of fluoride necessary for prevention of dental cavities. Extensive service operation has shown that the device will meter the prescribed one mg/L of fluoride under any condition of water temperature, pressure or flow.

The home fluoridator will be made available as a demonstration installation in private homes in the Pittsburgh area. For the present, home installations will involve 300 homes in suburban and rural Allegheny County, adjacent to Pittsburgh. Permutit will install the fluoridator, make periodic water tests and maintain the supply of fluoride. The device is designed to be tamper-proof after installation. Cost to the family will be approximately 6 to 7 cents per day after an initial service fee.

• • •

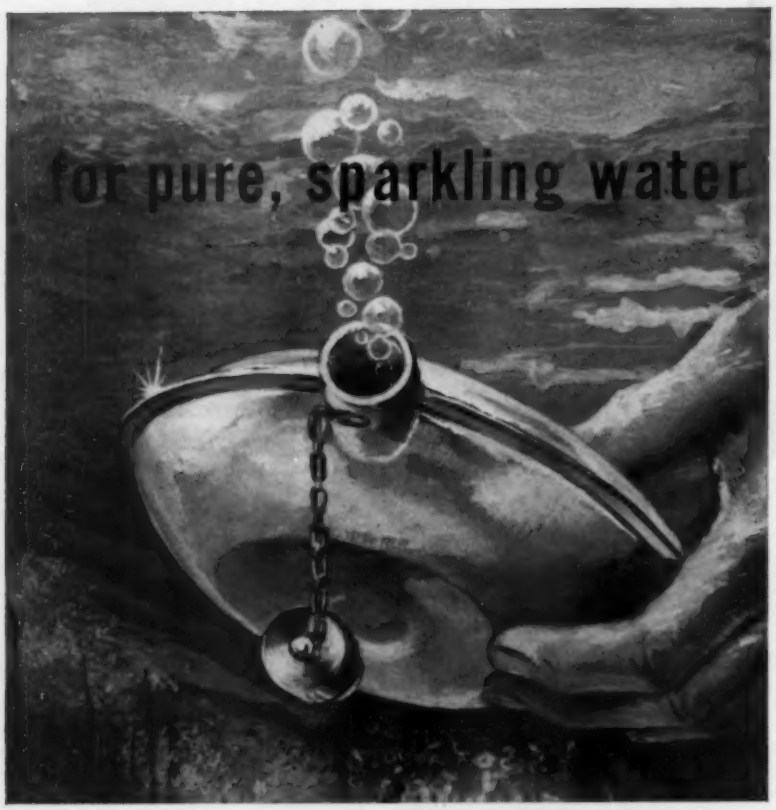
Utility Reimbursement for Relocation of Line

Reimbursement of utilities for the cost of relocating their facilities when necessitated by highway construction has been approved in Alaska, Georgia, Indiana, and Tennessee, and is pending in Alabama. The Alaska law declares utility relocation costs to be a cost of highway construction and requires such costs on Federal-aid highway construction to be paid by the state. The Indiana law requires the state to pay the utility relocation costs on the Interstate System. Tennessee enacted a law authorizing municipalities to pay the utility relocation costs on the Interstate System and be reimbursed from Federal funds.

• • •

Sprinkling Restrictions Limit Water Use

In Eagle, Colo., water use rose during the summer to 1,100 gallons per person per day, requiring restrictions on lawn watering due to distribution system limitations.



TRIANGLE BRAND COPPER SULFATE

Small, economical dosages of Triangle Brand Copper Sulfate will make your water supply palatable. It destroys algae and aquatic weeds that cause bad water odors and give water an unsavory taste. ■ Another important use of Triangle Brand Copper Sulfate is for the control of root growths, fungi and slime in sanitary sewers and storm drains without damaging trees and shrubs. ■ Write today for complete information on the use of Triangle Brand Copper Sulfate in water supply systems, sewers and drains.

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WHY YOU SHOULD SPECIFY
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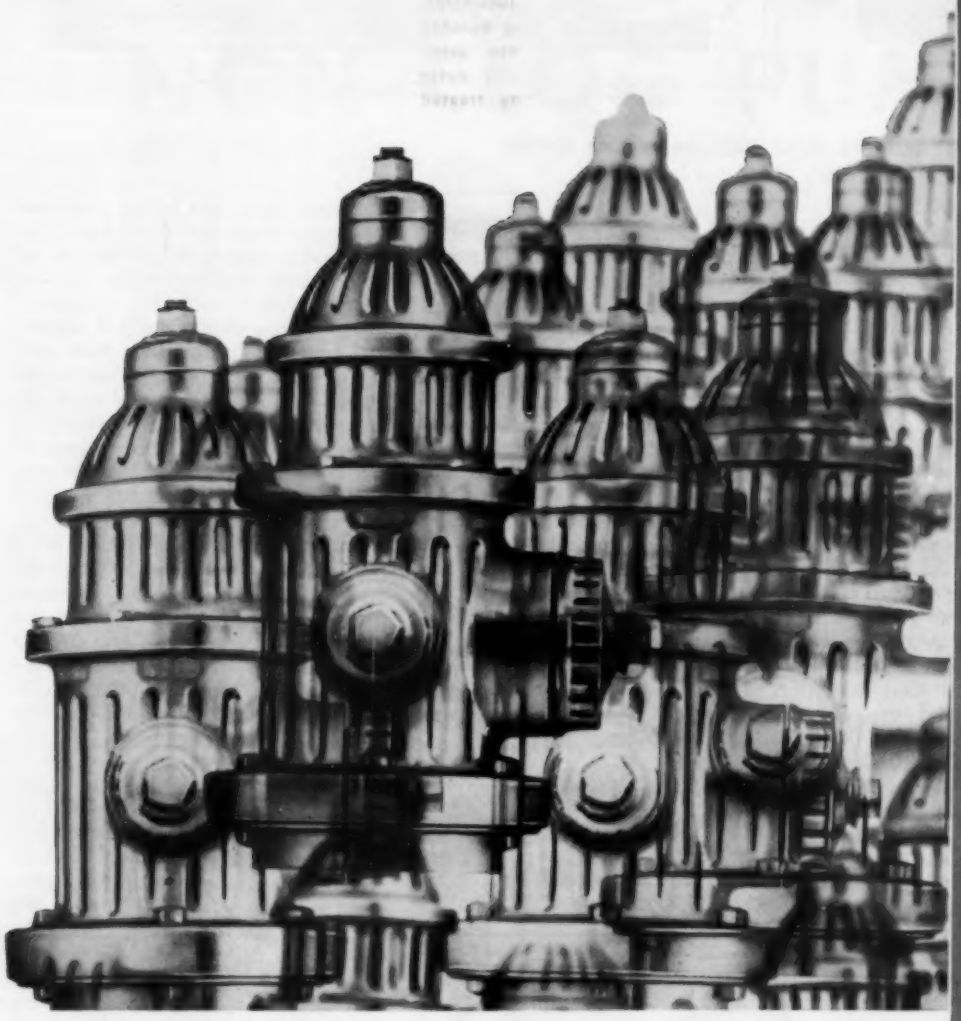


Reasons? Over a million hydrants now in service throughout the world. A number like that speaks for itself, says plenty about the outstanding features of the hydrant and the excellent service and reliability you can expect with R. D. Wood products.

Conform to A.W.W.A. specifications

R. D. WOOD COMPANY

FLORENCE, NEW JERSEY

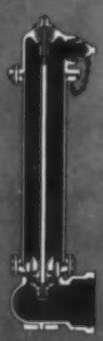
Established in 1803

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds)

THIS IS THE R. D. WOOD LINE

R. D. Wood Mathews Modernized Hydrant with replaceable barrel.

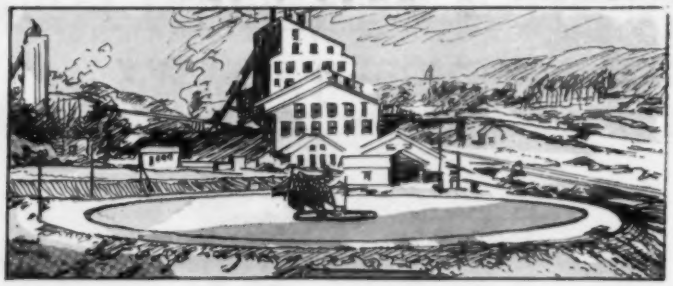
R. D. Wood Mathews Flange Barrel Hydrant . . . dry head construction keeps it operating in every kind of weather.



R. D. Wood Swivel Joint Hydrant can be faced in any direction.

R. D. Wood Gate Valve—bury it and forget it.

THE INDUSTRIAL WASTE DIGEST



Prepared by **CLAYTON H. BILLINGS,** ***Associate Editor***

Judging Pollution by Fish Takes

Fisheries statistics are important to the sanitary engineer in evaluating claims of damage from waste discharges, but they must be employed with care to avoid erroneous conclusions. Fishery resources are generally sensitive to many changes in their environment and pollution is but one of the many activities of man that act in an adverse manner. Several examples are given where use of incomplete data or failure to evaluate all factors having influence, resulted in false deductions on a specific pollution problem. However, there is a growing tendency to redefine pollution in terms of unnatural discharges that adversely affect man's total use of water. From this point of view, the statistics are among the best means for measuring the practical effects of particular water usage on the total water resource. Among the statistical parameters are 1) total catch of fish per unit of time, 2) fish population of an area, 3) catch per unit effort and 4) time of occurrence of migratory fish in an area.

"Fisheries Statistics in Evaluating Claims of Pollution." By Roger Tollefson, Consulting Biologist, Toledo, Oregon. *Journal of the Sanitary Engineering Division, Proceedings ASCE,* May, 1961.

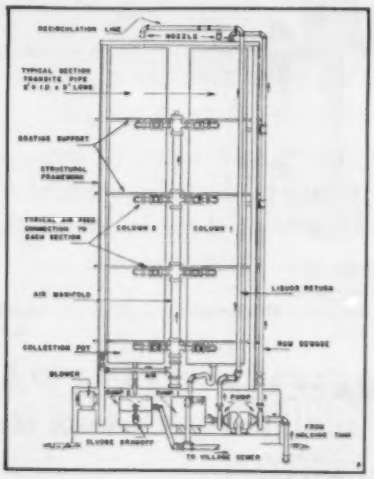
Degasification of Meat Packing Wastes

The full-scale anaerobic treatment plant for packinghouse wastes at Wilson and Co., Albert Lea, Minn., has been built in stages, permitting improvements to be made as found desirable. One of the problems was that the digester gases entrained in the mixed liquor passing to sludge separators caused erratic variations in the settling of the floc. After experiments with forced draft aeration, pressurized air flotation and vacuum degasification, the vacuum method was selected as the most economical, providing positive control without odor problems. The gas recovered could be used as added fuel in firing sludge heaters. It was also found that by employing the method the digester loading could be increased 300 percent and clarifier overflow rates could be increased 100 percent or more. Two degasifiers were installed, each eleven feet in diameter and 9 feet high. The liquor enters at the top of the tower containing packing of galvanized steel slats. A 20-inch absolute vacuum is maintained.

"Degasifying Digester Liquor." By A. J. Steffen, Wilson and Co. and R. M. Lemen, Permutit Co. *Wastes Engineering,* August, 1961.

Deep Trickling Filters For Whey Waste

During 1957-1958, a pilot plant trickling filter designed and operated on the principle of "controlled filtration" was applied to treatment of strong whey-bearing wastes. The plant was established at the site of the Dutch Hollow Foods Co. at Honeoye, N. Y. The filter comprised two columns built from 2-ft. asbestos cement pipe, of four 3-ft. sections each. Each section was separated from others in the column by a grating. The media consisted of 2½-in. stone placed to a depth of 2.5 ft. in each section. Effluent was collected in sumps at the base of the columns with provision for recirculation through either or both columns. Air was supplied through a common manifold with connections into the filter columns at the base of each section. The results suggested that with raw waste loadings in the range of 460 to 690 lb./day/sq. ft., removal of about 2/3 of the BOD may be anticipated. With average raw waste loadings in the magnitude of 1,150 to 1,380 lb./day/sq. ft. removal of BOD in the range of 35 to 40 percent can be anticipated even under adverse conditions. Efficiencies up to 70 percent with raw waste loadings in the range of 1,610 to 1,840 lb./day/cu. ft. have been demonstrated on the filter when operated without serious interruption of flow. The operation of the pilot plant within 50 ft. of the milk processing plant without nuisance demonstrates that such a plant may be built in proximity to a milk plant and operated as a pretreatment unit without difficulty and without any great ground area requirement.



Courtesy Journal WPCF

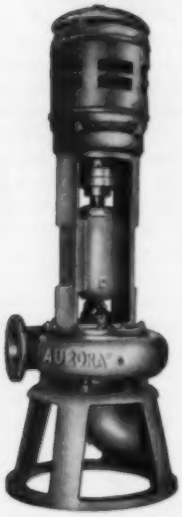
● **DEEP trickling filter, side elevation, used for treatment of whey wastes.**

"Trickling Filter Treatment of Whey Wastes." By William T. Ingram, New York University. *Journal WPCF,* August, 1961.

Bio-Oxidation of Nylon Wastes

The waste treatment facilities of the Pensacola Plant of the Chemstrand Corp. handles the wastes

OBJECTIVE PERFORMANCE
. . . EFFICIENCY AND ECONOMY WITH
AURORA® *Heavy Duty*
NON-CLOG PUMPS



TYPE KUC VERTICAL—For compact installation with flexible coupling drive... motor high above floor.

TYPE KCM VERTICAL—Utmost compactness... close-coupled design... low suction.

For handling heavy liquids... and solids in suspension. Ideal for public utility and industrial wastes.

Capacities to 9000 GPM • Heads to 150 feet • Solids size to 6 inches

- Easy Installation
- Easy Disassembly
- Smooth—Quiet operation
- Hand cleanout provided in casings
- Detachable suction and packing covers
- Large Passageways
- Many optional features available
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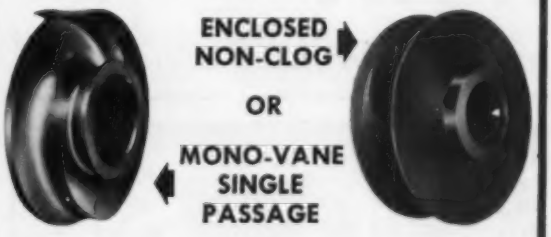
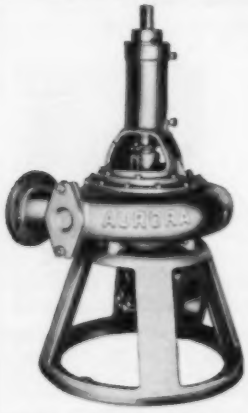
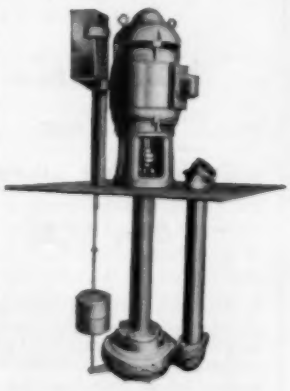
- Deep packing boxes

ALTERNATE IMPELLER DESIGN

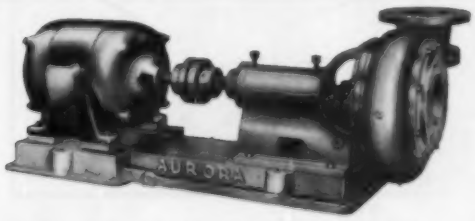




TYPE KU VERTICAL—For flexible shaft drive... misalignment proof ... elevated motor protection against pit flooding.



TYPE KS VERTICAL —For heavy duty wet pit service. Complete unit engineered to specific pit requirements.



TYPE KGG HORIZONTAL—Rugged base mounted unit ... for use where suction conditions permit horizontal mounting.

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from the manufacture of adipic acid, involved in nylon production. As originally constructed the plant provided for treating one waste stream by submerged combustion, mixing the wastes in a large lagoon, neutralization with ammonium hydroxide, dilution with recycled effluent, bio-oxidation by activated sludge, settling and storage for discharge regulation. Subsequent experience found that it would be advisable to use river water instead of recycled effluent for dilution, to eliminate post treatment storage and to provide for sludge disposal. The use of the river water for dilution produced a less dispersible sludge. A COD reduction of 85 percent was found to be attainable with loadings of 1.2 lb. of BOD per pound of volatile solids per day, with 2.500 mg/L suspended solids in the mixed liquor. Under these conditions no river pollution damage was anticipated and effluent storage was not necessary. It had been expected that waste sludge discharge would not be appreciable; but the need for disposal facilities soon became apparent. The treatment plant has since survived two process changes, one involving disposal of waste containing toxic adiponitrile. A decision to increase plant production resulted in considerable study to determine if such a move would be practical in light of the expense of waste treatment. By segregation of certain waste streams it was possible to isolate contaminated waste streams from the uncontaminated, and the treatment plant was able to handle the load. Use of the river water for dilution of the wastes led to seasonal sludge upsets caused by infection from bacteriophage, as determined from electron micrographs. It was found that sludge age had much to do with the susceptibility of the sludge to infection and young sludge was the most resistant. Reducing the solids level solved the problem.

"Nylon Waste Treatment." By B. T. Dean, Chemstrand Corp., Pensacola, Fla. *Journal WPCF*, August, 1961.

Radioactivity in Lake Michigan Water

During nuclear weapon test periods and for six months following, research at Chicago's South District Filtration Plant showed that the Lake Michigan water increased in gross radioactivity. In the absence of fallout the average gross activity of the lake water dropped, the rate of decline being greater that can be explained entirely by radioactive decay. It is assumed that a large portion of the fallout material settles on the lake bottom and that during periods of high turbidity a portion of this radioactive material is brought into either solution or suspension. This would help explain the correlation between high turbidity and high gross activity that has been noted for the past few years. While the amount of gross radioactivity in the lake water has never reached a dangerous level, several times during periods of heavy fallout it has exceeded a maximum desirable level of 10 μμc/L as defined by the AEC for lifetime consumption of unidentified isotopes in water. The average alpha activity has not followed the gross activity trends, so one can assume the alpha activity was of natural origin or independent of fallout. In 1960 the raw lake water averaged 2.90 μμc/L, while in 1959 the average was 9.17 μμ/L. During 1957, the raw lake water averaged 12.22 μμ/L due primarily to weapon tests on this continent. The maximum month for the last five years was

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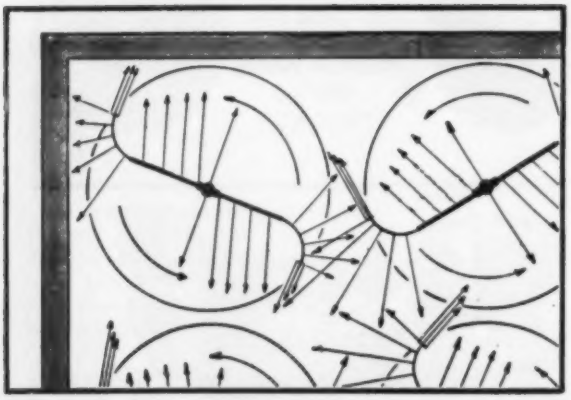

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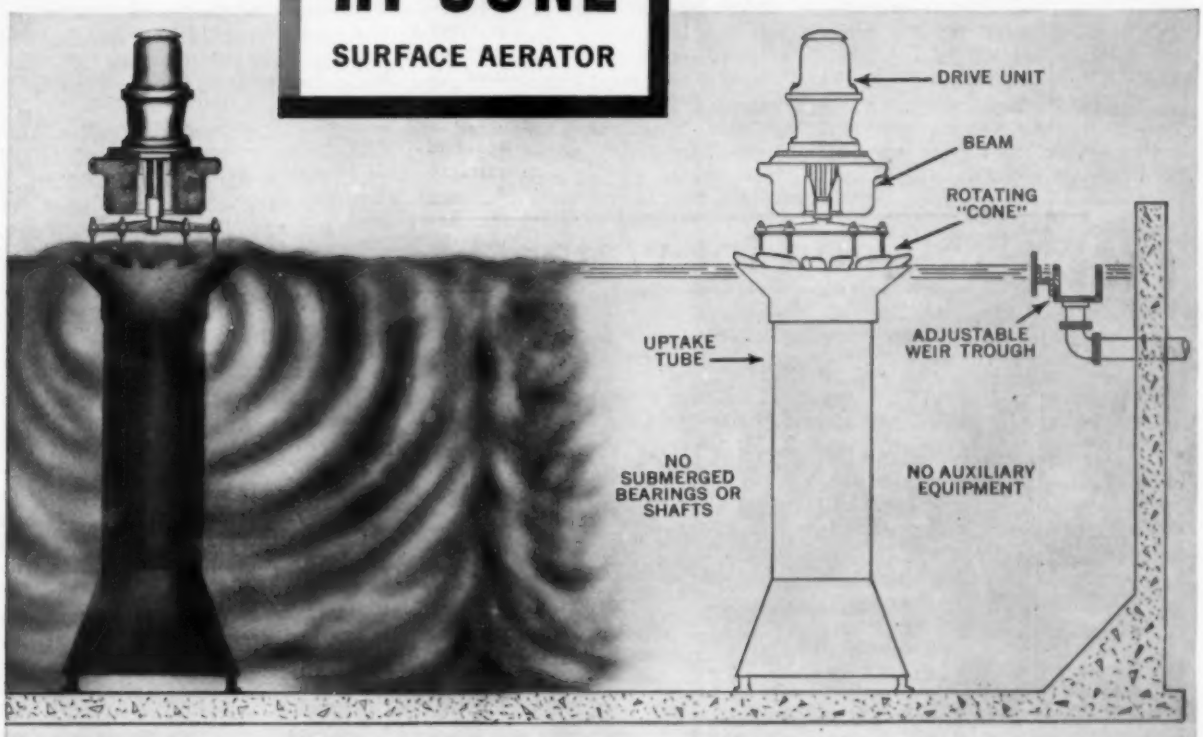

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2	46	54.0	10.0	.185
4	34	27.7	4.9	.177
4	50	54.0	9.5	.176

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July, 1957, which averaged 42.03 μμc/L gross activity, as compared with the maximum month for 1960, February, which only averaged 4.19. The filtered outlet water averaged only 2.24 in 1960, as compared with 5.26 in 1959. The maximum month in 1960 was August with only 2.82 μμc/L. The 1960 data gave a removal factor of 22.6 percent for gross radioactivity, and for alpha data 26.0 percent. At the low levels of gross activity currently found in the lake water, radioactive potassium-40, a naturally occurring isotope, contributes over one-half the observed gross activity. During December tests were conducted to determine experimentally, the contribution of potassium radioactivity to the gross activity found in the raw lake water. The data agreed with the theoretical calculations based on the concentration of natural potassium and the isotopic abundance, nuclear properties and the decay schematics of potassium-40. The lake water averages about 1 ppm potassium which would correspond to about 1.4 cpm/liter gross activity. Since potassium is very soluble it is not precipitated by coagulants during water treatment. Also, since it has only a singly charged ion it is not strongly adsorbed on floc particles, turbidity or sand grains. During periods of low turbidity much of the gross radioactivity is due to soluble potassium. In order further to clarify the problems involved in the removal of radioactivity and the effects of long-range fallout, a rather complete tabulation of data is included with this report summarizing gross radioactivity data for 1957 through 1960 and alpha activity in 1960.

"Radioactivity Measurements Review." By R. W. Schmidt and Alfred M. Tenny, South District Filtration Plant, City of Chicago Dept. of Water and Sewers. *Pure Water*, April, 1961.

New Technique for Odor Evaluation

In applying gas chromatographic technique to analyzing volatile chemicals responsible for the flavor of foodstuffs, the authors have developed a sensitive method of identifying odors which is applicable to those associated with air pollution. Chromatographic methods in the past have been complicated by the interference of the solvent used for extraction as well as interference by water. By employing an ionization detector, a much higher sensitivity is achieved, vapor samples of 1 microliter to 5 ml. can be used, and temperatures above that of sampling are not required in the test. The experimental work involved the use of the argon chromatograph distributed by Jarrell-Ash Co. and the Barber-Colman Model 10 gas-liquid chromatograph. Results were obtained from a variety of foods, beverages and flavoring materials and were related to sensory experience. It was found that direct correlation of the measurements with sensory evaluation is possible.

"Objective Measurement of Odor —Ionization Detection of Food Volatiles." By D. A. M. MacKay and M. Berdick of the Evans Research and Development Corp., New York, N. Y., and D. A. Lang, American Chicle Co., Long Island City, N. Y. *Analytical Chemistry*, September 1961.

Predicting Rinse Concentrations

In metal finishing industries, sufficient rinse water must be used to maintain the quality of the metal. To avoid pollution, the amount of rinse water used must be kept to a minimum. Equations have been de-

Roll-call for water

the Bird Woman's home

When Lewis and Clark first explored western United States, they found an exceptional Indian woman in what is now Missouri. Her name was Sacajawea (said to mean bird woman) and her services as guide and interpreter to the expedition were invaluable. It was a wild and rough journey. There were no cities and no public water distribution system in the Prairie Belt states in those days. But the report of their expedition inspired thousands of eastern people to organize wagon trains and start West from St. Louis, as Lewis and Clark had done, up the Missouri River and her tributaries.

Today this Prairie Belt of 7 west-north-central States produces grain and is sometimes called America's bread basket. The Indians and the buffalo are gone. In their place are modern farms, homes, highways, railways, airports and cities. Of the 40 cities of 25,000 population or more, 29 have adequate water systems, 5 have water works of uncertain efficiency, and 6 have water works which are definitely deficient in overload capacity.

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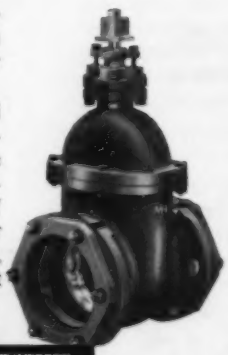

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veloped on the assumption that complete mixing occurs during the rinse operation. These will predict the tank concentration generally within 10 percent and are suitable for waste treatment design considerations. However, such facilities are primarily concerned with tank concentrations and not tank dragout (solution adhering to the metal after rinsing). The dragout is of most importance to the finisher, making the equations based on complete mixing unsatisfactory to him. Equations have been developed from actual mixing relationships considering the fraction of the unremoved contaminant, which must be measured for each instance. Diffusion or convection was shown to be more important than drop dispersal in rinsing techniques, the contact time greatly affecting the amount of contaminant removed in the case of flat shapes. Substantial improvement in rinsing effectiveness would probably result from agitation of the metal or of the film adhering to it.

"Rinsing Effectiveness in Metal Finishing." By John A. Tallmadge, Jr., and Bryan A. Buffham, Yale U. *Journal WPCF*, August, 1961.

Other Articles

"Dephenolization of By-Product Coke Plant **Ammoniacal Liquor.**" By Walter E. Carbone, Wilputte Coke Oven Div., Allied Chemical Corp. A review of the process and plant facilities developed over the past three decades of experience of the Wilputte Coke Oven Division. Journal WPCF, August, 1961.

"Treatment of Wastes for Auto Bumper Finishing." By C. C. Cupps, Rockwell-Standard Corp. **Chromic acid wastes** are reduced by bringing about a reaction with the pickle liquor from an earlier step in the finishing process. Industrial Water and Wastes, July-August, 1961.

• • •

County Master Plan

(Continued from page 105)

age treatment plants are normally located along the streams at the lower end of the drainage basins. But in cases where there is heavy population growth in an upstream area, it may be more economical to locate a plant to serve only that area, rather than locating it at the mouth of the stream.

Following these criteria, the County would be divided ultimately into 15 sewerage regions, as shown on Figure 2, with each region generally being served by a treatment plant, except two of the regions

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which would discharge into the Philadelphia sewer system for treatment at the City's Northeast Treatment Plant.

In the future, comparative studies may show that it would be economically feasible to combine some of the regions, thus reducing the number of treatment plants but building larger interceptors instead. The master plan could then be revised accordingly.

Table 2 summarizes the sewerage data. By the year 2010 the number of people served would increase to 400 percent of the number presently served. The capacity of the treatment plants would increase to 350 percent of the present capacity.

Cost estimates have been made for the anticipated facilities. The costs represent current construction costs, including an allowance of 20 percent for engineering, administration, and overhead. Local construction items, such as sewage collection systems and water distribution systems, are not included. The costs are summarized as follows:

For the first stage (to be completed by 1965)—$13,815,000 for water supply facilities and $13,725,000 for sewerage; second stage (1980)—$19,265,000 for water, $11,265,000 for sewerage; third stage (2010)—$31,070,000 for water and $7,920,000 for sewerage.

The entire cost of the 50-year program would be $97,060,000.

Implementation of the Plan

The Board of County Commissioners is taking steps to see that the plan is carried out and not relegated to a dust-gathering situation. While the County does not now have any direct jurisdiction by means of which it can implement the plan, the Commissioners have appointed a Water and Sewage Commission to study the problem and recommend courses of action. This Commission has recommended the creation of a county water and sewer authority and this proposal is now being considered by the Board of County Commissioners. The Commission has also been conducting an active public-information program in those areas where sanitary facilities are most needed and where regional cooperation is required. □ □ □

• • •

Are Domestic Sewage Lagoons Safe?

(*Continued from page* 126)

fowl will pay no attention to the signs. In fact in the article in the *Reader's Digest*, the author boasts of the fact that the water is clean enough for ducks and geese to swim in. When these birds fly to other bodies of water or even in some cases to reservoirs that store drinking water, they will carry with them bacteria attached to their feet and feathers. At a trial, I witnessed not long ago where the property owners were trying to prevent a city from building a lagoon near their homes, the engineer who designed the lagoon testified that he had on numerous occasions hunted ducks on such bodies of water. This shows a lack of understanding of the problem involved.

Mosquitoes and other insects can breed in the waters of these lagoons and it is for this reason that the boards of health specify that weeds must be kept from growing in them or at their edges. Does the absence of weeds insure the absence of mosquitoes? What assurance can one give people that may be living near one of these lagoons that the mosquitoes they find in their yards are not coming from the lagoon.

According to the article in the *Reader's Digest*, the pond should be

(*Please turn to page* 214)

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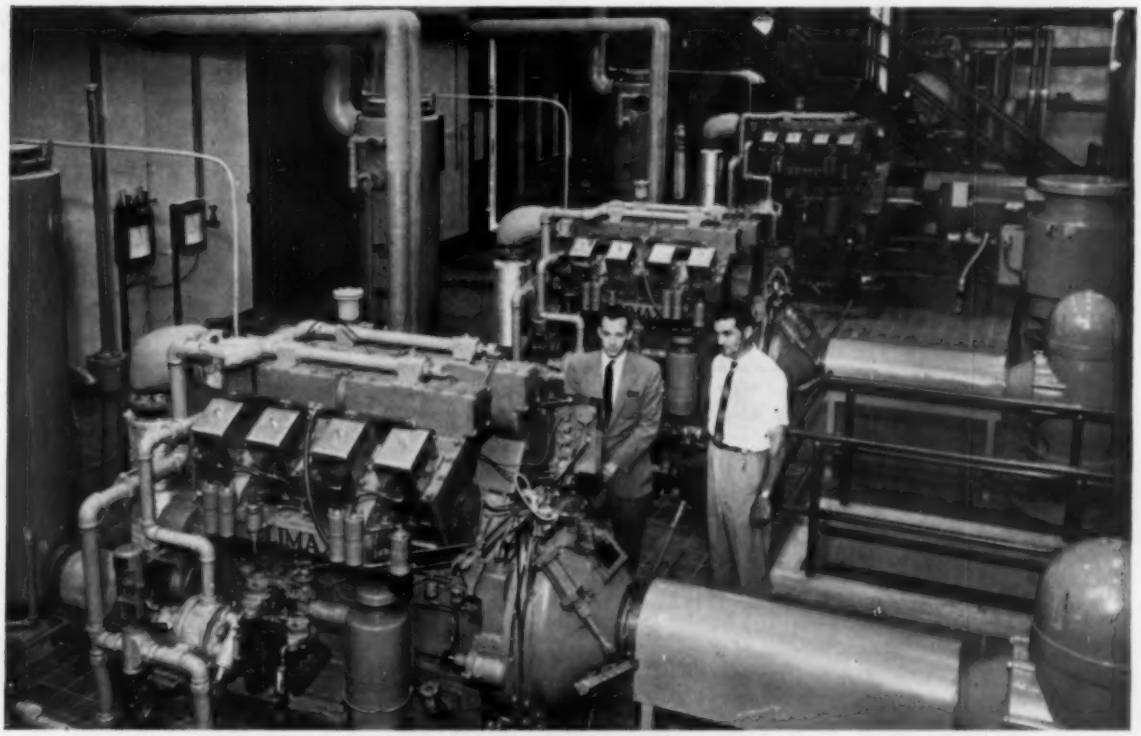

Sarnia, Ont., sewage treatment plant. *Consulting Engineers:* James F. MacLaren & Associates, Toronto.
Prime Equipment Suppliers: Babcock-Wilcox & Goldie-McCulloch Ltd., Galt, Ont.
Engines supplied by Atlas Polar Company Limited, Toronto.

In Sarnia, Ontario's modern sewage treatment plant two Climax V-85 Engines pull the pumps; a third drives an alternator supplying all auxiliary power. These engines operate primarily on sewage gas with automatic change over to natural gas in case of a failure of the sewage gas supply. # Capacity of each Babcock-Wilcox pump is 10-million Imp. gal. daily at 880 rpm; 7-million gal. at 760 rpm; 3-million gal. at 640 rpm. A Woodward PG-PL hydro-pneumatic governor ensures infinitely variable low to high speeds. # The Climax Engines, sold by Atlas Polar Co. Ltd., Toronto, drive the pumps through right angle gears. Engine clutch-mounted air cylinders, controlled from master panel, provide automatic engagement and disengagement. Engines have Sims waste heat exhaust boilers, supplied by Climax; and coils in sludge tanks cool the engines so that waste heat from jackets is also used in sewage treatment. # The third Climax V-85, equipped with a Woodward UG8 governor, and direct-connected to the 125 KW, 900 rpm, 60-cycle Tamper alternator, is designed to operate continuously. It was built by Atlas Polar. These Climax V-85's are 8-cylinder, 60-degree, V-type, 7½-inch bore x 7-inch stroke, 2474 cubic inch engines. All three have Synchrostart safety shutdown control panels. Send for descriptive Bulletin SA-631.

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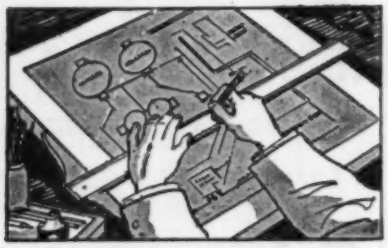

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constructed in an area where there is a reasonable amount of clay to prevent excessive seepage. Why should it be undesirable to have excessive seepage; and what constitutes excessive seepage? In most states underground disposal of sewage is prohibited because of the danger of contaminating underground water supplies. In such cases contamination means that sewage bacteria have found their way into the underground water system. If this can happen from underground disposal systems, it can also happen from surface disposal systems if the untreated sewage can seep into the ground. I wonder if the Public Health Service engineers have determined what constitutes excessive seepage and, in every case where lagoons are built, are adequate tests made to determine if the soil contains enough clay to prevent this excessive seepage. If clay has to be hauled in to prevent this seepage the cost will be considerably higher than that indicated in the article.

There is now a new danger from sewage seepage, namely that of contaminating the underground water strata with synthetic detergents.[2] These synthetic compounds, generally not subject to bacterial decomposition, will remain in the water much longer than the sewage bacteria and also penetrate further into the ground without being decomposed. In most lagoons, if not all, there is a great difference between the amount of water flowing into them and the amount of overflow, if any. Some of this variance is due to the evaporation that takes place at the surface. With the exception of very hot and arid areas the evaporation cannot keep up with the inflow. The major portion of the discrepancy between the inflow and outflow must be due to seepage.

In the article in the *Reader's Digest*, mention was made of the apprehension on the part of the public about disagreeable odors from lagoons and that experience has shown there is no such danger. In general, biologists will agree that organic waste from 100 persons, distributed uniformly in water that spreads over one acre, will not be sufficient to create any odor nuisance. The inference in the article is, if there is no odor, there is no danger involved. This, of course, is not factual since the real danger from these lagoons is from disease producing bacteria and viruses.

Mention was made above that there is little danger from odors in these lagoons if the organic matter

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is uniformly distributed; this does not always happen. Some lagoons have been built that occupy from 400 to 600 acres and were designed to take care of a fairly large community; therefore, a considerable amount of sewage is involved. If this is discharged into a single inlet or even in a few inlets, the concentration of organic matter at local spots will be so great that very noticeable foul odors can occur.

The article in the *Reader's Digest* claimed the cost of a lagoon process would be only about 45 percent of the cost of a mechanical type treatment process. If the cost referred to includes only the cost of constructing the lagoon itself, this might be true, but in some cases, this will not be the only cost. A suitable site may be located some distance from the community, and the connecting sewer will contribute considerably to the total cost. The boards of health specify that a lagoon must be built at least a quarter-mile from residences. This means the community must obtain easements to a fairly large piece of land on which the lagoon is to be located. No farmer would be expected to allow the lagoon to be constructed on his farm without reasonable compensation. If residences cannot be built within a quarter-mile radius of the lagoon, this means the land that lies within this distance may have its future use restricted; therefore, the owner would be entitled to damages for this future restriction of its use. The cost of the land may, therefore, be a major item. If the land is not level, a great deal of dirt removal or moving will be necessary in order to get the desired acreage of perfectly level land. The lagoon should not be more than three feet deep and it must have a uniform depth over-all. The cost of leveling this land can be considerable. To this must be added the lost revenue if the land is removed from cultivation. Also the taxes there must be lost. These costs must be figured into the operating or yearly expense if one is to be correctly informed on the expense involved.

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PUBLIC WORKS

EQUIPMENT NEWS

Snow Wing

Owners of Caterpillar wheel loaders can have a completely equipped snow fighting machine with the Omsteel snow wings. The wing can be used to push high banks back to make room for the next snow fall or to clear the shoulders after a light snow fall. It is controlled by two in-cab controls. One raises and lowers the wing in level position; the other raises or lowers the outer end. Adjustment of the telescoping strut changes angle of attack. A removable cutting edge is adjustable to compensate for wear. The wings are available for 966 and 944 wheel loaders. Also available are V-Type snow plows for the Caterpillar loaders.

Omaha Steel Works, 609 So. 48th St., Omaha 6, Nebr.

Circle **No. 10-1** on the convenient reply card facing page 34

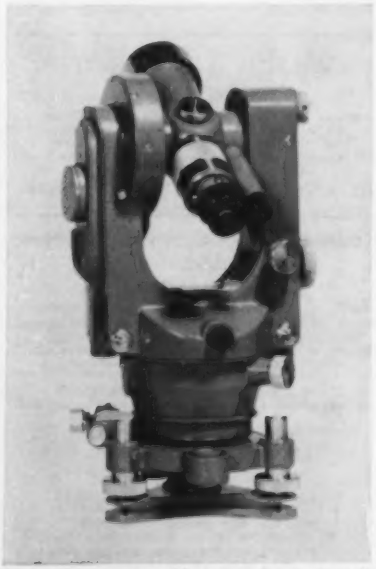
Herbicide Spray

This portable hand-gun spray unit utilizes the Stull nozzle and a non-drift invert herbicide for brush and weed control. A spray distance of fifty feet, combined with the non-drift characteristics of the mayonnaise-like spray, provides spraying accuracy and eliminates drift in spraying irrigation ditches, fence rows, rights-of-way and brushy and weedy areas. Powered by a 7½ hp air-cooled gas engine, the pumping output may be readily varied over a wide volume and pressure range. The Bifluid process is accomplished with one feed-line to a drum of water—the other to the special chemical formula. Both are connected to the nozzle where the components are intimately mixed and the water-in-oil emulsion is formed. This emulsion is a mixture of water, non-aromatic oil and herbicide. Other additives include a surface active agent, an emulsifier and sticking agent. The heavy consistency of the emulsion not only eliminates drift but adds to its clinging ability for optimum efficiency. Dual triggers on the hand-spray have self-locking devices for constant spray. Triggers may be worked independently to operate the multi-purpose gun which is equally efficient for spraying insecticides, buildings and trees.

Stull Chemical Co., 3400 Nacogdoches Rd., San Antonio, Texas.

Circle **No. 10-3** on the convenient reply card facing page 34

Sprays up to 50 feet without drift.



Erecting image telescope is featured.

Transit

The "E" Model of the Wild T-1A optical repeating transit offers an erecting image telescope to engineers and surveyors who prefer working with upright images. The T-1AE also embodies the latest optical and mechanical developments for fast, accurate work in land surveying, layout and topography. Micrometer reading is to 20 seconds direct. Vertical circle is self-indexing. The instrument has upper and lower azimuth motions for setting on zero and repeating. Finish is a field-tested green with high heat-reflecting, low light-reflecting qualities.

Wild Heerbrugg Instruments, Inc., Main and Covert Sts., Port Washington, L.I., New York.

Circle **No. 10-2** on the convenient reply card facing page 34

Lamp Positioner

A luminaire lowering mechanism that permits ground level maintenance on street lights, area lights and flood lights, a device approved by UL, is available on a wide range of P & K aluminum lighting standards, single and twin arm modes with truss arms up to 15 feet long. This device can be used to support pendant-type incandescent or mercury vapor luminaires and bail or yoke-suspended single or twin flood lights. The unit has been found especially suited for locations inaccessible to the usual maintenance equipment or where such equipment is not on hand. With this device, ground level relamping or luminaire service becomes convenient and economical.

Pfaff & Kendall, 84 Foundry St., Newark 5, N. J.

Circle **No. 10-4** on the convenient reply card facing page 34

Bonding Additive

As a bonding additive for mortar and concrete, Albitol provides permanent bond between old and new concrete and improves the physical properties of concrete, particularly the elasticity. These properties produce lasting concrete repairs on highways, bridges, sidewalks, airports and other difficult locations.

American Vamag Co., Inc., 1615—51st St., North Bergen, N. J.

Circle **No. 10-5** on the convenient reply card facing page 34

Stump-Cutter

A tractor mounted, pto-powered stump cutter can remove as many as 15 stumps (up to 12" below ground) in less than two hours. The unit, which mounts on any 3-point hitch tractor in the 42 drawbar hp class is hydraulically operated and controlled, and chews stump and root fibers at the rate of 12" per pass. The travel speed of the cutting wheel is adjustable up to 20" per minute. Safety is assured through heavy steel shields and deflector plate. Wood chips average only thumb-nail size.

Wagner Iron Works, Milwaukee 1, Wisconsin.

Circle **No. 10-6** on the convenient reply card facing page 34

Catwalk Platform

This versatile, highly-controllable catwalk platform is designed as an attachment for the Teale "200" fully - hydraulic, truck - mounted crane. The 4-foot wide platform attaches directly on the 16-ft. boom. The 12-foot length folds down to a roadable, 8-foot width, by swinging the hinged end-sections back. With on-platform controls, workmen can raise (up to 25 feet), lower and revolve the platform. The catwalk has a capacity of 1000 lbs. with crane outriggers to stabilize platform.

Teale & Co., P. O. Box 605, Downtown Station, Omaha 1, Nebr.

Circle **No. 10-7** on the convenient reply card facing page 34

Conveyor Loader

A continuous forced feed conveyor loader, mounted to the Massey-Ferguson 65 tractor is used for such material handling jobs as stockpile loading, windrow pickup, scarifying and stripping, and for pit and bank loading. The rig is designed for continuous-type loading in quarries, material yards and power plants with users ranging from contractors and utility companies to townships, municipalities, counties and state highway departments.

Harrington Mfg. Co., Lewiston, N. C.

Circle **No. 10-8** on the convenient reply card facing page 34

Turbidity Transmitter

An instrument that measures the percentage of solids in a liquid and transmits this measurement to recording and/or indicating equipment at remote stations up to 500-ft. distant, the Bailey type UT1100A Turbidity Transmitter unit includes a flow chamber, a light source and a bolometer. It is a relative measuring device that can be calibrated for any convenient range and units. The transmitter is capable of operating at pressures up to 60 psig and temperatures up to 250F. It requires three external wire connections for the measuring circuit and two wire connections for the power supply. All-glass, sealed-beam construction is used in both light source and bolometer. These units are sealed in weather proof, die-cast aluminum housings.

Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio.

Circle **No. 10-9** on the convenient reply card facing page 34

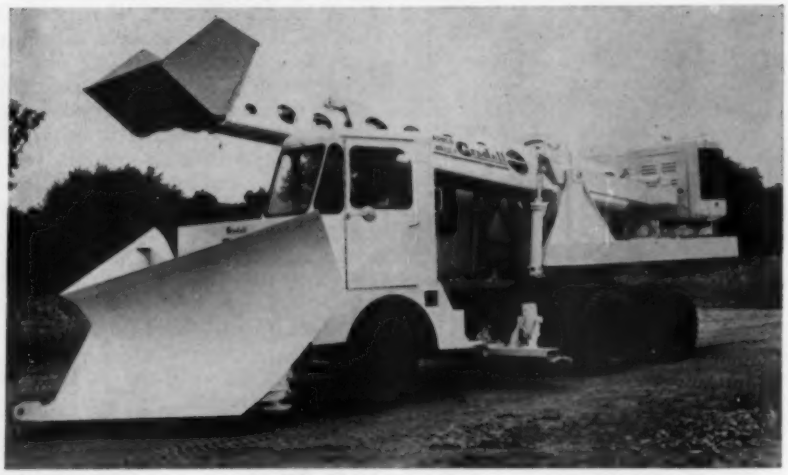
Speed Recorder

This visible RPM speed recorder is designed for use on off-highway equipment and over-the-road trucks when tachometers are not desired or not available. The existing drive cable connects directly into the base of the recorder. In addition to recording the actual rpm's by one stylus on a wax-coated chart, it also records engine idling time. A second stylus marks working and idle time. An amber light comes on when overdriving and a red light shows lugging. RPM range settings are pre-set to engine manufacturers' specifications and are adjustable.

The Service Recorder Co., 1017 Rockwell Ave., Cleveland 14, Ohio.

Circle **No. 10-10** on the convenient reply card facing page 34

Plow Attachments



Two snow plow attachments for the Gradall machines include a V-type snow plow and a one-way snow blade to push the snow to one side of the roadway. These snow-handling attachments make the Gradall a more versatile machine to aid in road maintenance.

The Warner & Swasey Co., Cleveland, Ohio.

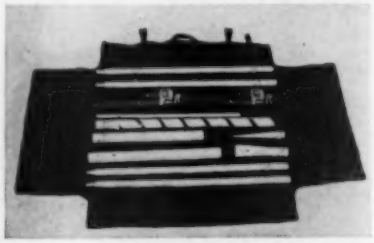
Circle **No. 10-11** on the convenient reply card facing page 34

Soil Kit

The Soil Exploration Kit contains a variety of soil sampling tools for use in recovering samples of most overburden material to shallow depths. The kit is hand operated and is furnished in a standard metal box or in optional canvas tool rolls for greater ease in transporting.

Penndrill Mfg. Div., Pennsylvania Drilling Co., 1205 Chartiers Ave., Pittsburgh 20, Pa.

Circle **No. 10-12** on the convenient reply card facing page 34



Water Plant

The key to the Microfloc water treatment process lies in the coagulant control center, which constantly monitors the process, and in the proper construction of the separation beds. Operators can set the control for a desired water quality and are immediately alerted if raw water conditions change necessitating changes in chemical feed. Separation beds differ from conventional rapid sand filters in that the entire depth of the bed is used to hold the suspended matter. Backwash requirements are about the same as with conventional plants per million gallons.

MicroFloc Corp., P. O. Box 22001, Wilshire Branch, Denver 22, Colo.

Circle **No. 10-13** on the convenient reply card facing page 34

Chipper

The large feed table on the Asplundh chipper is designed for feeding from the sides, and allows passage of bulky branches. As optional equipment, a blower attachment is also available which eliminates the chute stoppage of fine brush and foliage, expedites dispersion and discharge, and can be installed on any chipper.

Asplundh Chipper Co., Chalfont, Pa.

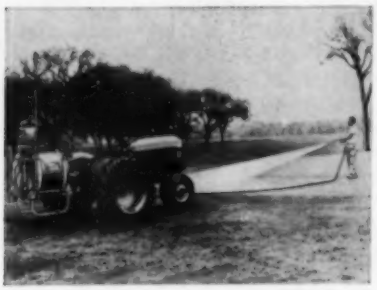
Circle **No. 10-14** on the convenient reply card facing page 34

Portable Sprayer

This special high and low pressure portable sprayer can be used for either hand or vehicular application. Counties and cities have found it useful for application of chemicals to care for turf areas. The high pressure system can be utilized for spraying trees and shrubbery. The unit can be attached to any standard 3-point hitch. Mechanical agitation assures complete mixing.

The Broyhill Company, Dakota City, Nebraska.

Circle No. **10-15** on the convenient reply card facing page 34



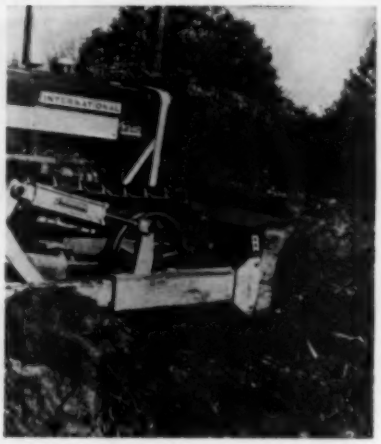
Trip-Edge Plow

This automatic trip edge snow plow has a spring-loaded trip cutting edge embodied in a line of reversible and one-way plows for trucks and Caterpillar wheel loaders. This safety feature allows the plow to "ride over" any hidden obstruction in the roadbed without damage to plow, injury to operator or strain on the power unit. Because only the edges trip, rather than the entire plow, the load is maintained. When the cutting edge strikes an obstruction, it swings back and under the blade, letting the obstacle pass under without catching on the plow. The cutting edge then springs back to original position.

Balderson Inc., Wamego, Kans.

Circle **No. 10-16** on the convenient reply card facing page 34

Angle Dozer



The manual angle and tilt dozer blade No. 700, designed for front mounting on International crawlers in the below 50-hp. class, can be used to build roads and driveways, plow snow, clear brush lands, clean feed lots, dig ponds and do other related dozing work. Fitted for the T-340 and TD-340 crawler tractors, the blade can be angled right or left to 27 degrees with the use of only two pins, while a second adjustment allows the blade to tilt 8 degrees in either direction. The 92″ x 28″ moldboard is reinforced top and bottom by formed box sections and is curved to give a plow-like roll to the soil to get the most from the power of the tractor. Adding to the power advantage of the dozer are two 3½″ x 12″ cylinders which supply a 48-inch lift and 12-inch drop. The cutting blade is made from heavy ½″ x 6′ steel and for economy is reversible.

International Harvester Company, 180 North Michigan Ave., Chicago 1, Illinois.

Circle **No. 10-17** on the convenient reply card facing page 34

Vinyl Fence

Chain-link fence material in a wide variety of colors and color combinations is now available for industrial, highway and residential use. The product is produced by a process which takes standard galvanized steel wire and permanently surrounds it with a special vinyl compound. The wire is then fabricated into the fence material. Known as Colorbond, the fencing can be manufactured in any shade or hue or any combination that may be desired.

Colorguard Corp., 35 W. 53rd St., New York, N. Y.

Circle **No. 10-18** on the convenient reply card facing page 34

Diesel Tractor

These industrial tractor models, the 203 and 205 series, are both powered by a 152-cu. in., three-cylinder diesel engine which will deliver 12.5 percent more power than a four-cylinder gasoline engine of comparable size. Developing 40 hp the diesel-powered 203 and 205 tractor series average less than 1½ gallons of diesel fuel per hour under all kinds of loads. The M-F 205 model is equipped with instant reverse and torque converter. Both new diesel tractor models are designed for all kinds of construction and maintenance jobs. Attachments available for the 203 and 205 models include loaders, multi-purpose blades, angle dozers, post hole diggers, backhoes, mowers, rotary cutters, reversible soil scoops and a cable layer.

Massey-Ferguson, Inc., 1009 S. West St., Wichita 15, Kans.

Circle **No. 10-19** on the convenient reply card facing page 34

Truck Line

Introduction of diesel power in medium and heavy-duty models, two larger displacement engines, broader power team options across the line, lower hood lines for improved driver visibility, and extra heavy-duty optional front suspensions, highlight the 1962 Chevrolet truck line. Other features include extended life mufflers on all but three series, optional alternating current generators on gasoline models, and directional signals as standard equipment on all but one series. Engines available for the first time in the 1962 Chevrolet truck line include one General Motors diesel, a 212 cu. in., 130 hp. in-line four; and two gasoline V8's of 327 and 409 cu. in. displacement, developing 185 and 252 hp. respectively. The Corvair 95 line is continued for 1962 with further refinements in the design introduced last year. These include an automatic choke, an optional limited slip differential, redesigned double side door locking mechanisms in panel models for easier operation and convenience of the driver, and an optional single passenger seat which folds forward.

Chevrolet Motor Div., General Motors Corp., Detroit 2, Mich.

Circle **No. 10-20** on the convenient reply card facing page 34

Refuse Body

The M-B Pack-King all-hydraulic refuse collection body has the hydraulic packing mechanism located up front in the body, above the two side loading doors. Refuse is placed in the loading area from either side of the unit. When this area is full, the material is lifted with a curved plate, then swept into the body by a packer plate. A packing pressure of 10 lbs. per sq. inch is developed. The unit is available in four sizes—14, 16, 20 and 24 cu. yd. capacities and can be mounted on any truck chassis.

M-B Corp., New Holstein, Wis.

Circle **No. 10-21** on the convenient reply card facing page 34.

Post-Mounted Luminaire

A mercury powerpack post-mounted luminaire, designed for application flexibility and appearance, the PMA-115 is offered with built-in ballast for 175-watt or 250-watt 7,000-lumen mercury-vapor lamp, and can accommodate up to a 405-watt 6,000-lumen incandescent lamp for applications requiring shorter burning hours. Besides a choice of lamp types and sizes, the PMA-115 is available with a narrow, medium or wide rectangular light distribution, a circular light pattern, or four-way light distribution pattern; with individual photoelectric control or for remote control switching, and in aluminum and five optional colors. A feature of this luminaire is its shatter-resistant acrylic refractor, same as that utilized on the GE Acrylic-Suburban luminaire. With the low heights at which the PMA-115 will be mounted the plastic refractor will reduce vandalism. The unit is intended to be used where low mounting heights (10 to 20 ft.), light control and decorative appearance are important—pedestrian malls, walkways, driveways, parks and campuses, building entrances, around statues and benches.

General Electric Co., Schenectady 5, N. Y.

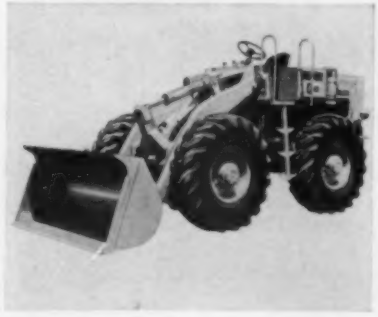
Circle **No. 10-22** on the convenient reply card facing page 34.

End Loaders

Two four-wheel-drive, rubber-tired, front-end loaders, Payloader Model H-60 with 1¾ cubic yard capacity and Model H-70 "C" with 2½ cubic yard capacity, feature simplified Hough bucket and boom mechanism. Extra strong, box-section boom arms are located ahead of the operator's compartment for maximum safety. The single bucket-control cylinder is removed from areas of possible spillage. This advanced design results in fewer pivot and grease points to service and maintain. Simplification of maintenance has been achieved by sealed pivot-point protection. A stock of only three hoses will service the entire hydraulic system. The tractor-shovels have power-steering, power-brakes and power-shift transmissions. Drott "4-in-1" buckets, operator cabs rotary and blade snow plows and bucket teeth are among the options offered.

Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill.

Circle **No. 10-23** on the convenient reply card facing page 34.



Reversible Plow

In this series of reversible trip-blade snow plows, the "A" frame assembly is relocated on top of the reversing frame to permit ample road clearance and to provide additional leverage for straight ahead push. Another feature of the plows is the use of four heavy-duty self-cleaning, screw-adjustable compression springs. Two additional inner springs cushion shock and limit the trip of the entire moldboard to pass over obstructions without damage. The plow can be set at five different positions: 35 and 42 degrees, right or left, plus center. Adjustable six-position push plates permit the plow to conform to various truck frame heights.

Wausau Iron Works, Wausau, Wisconsin.

Circle **No. 10-24** on the convenient reply card facing page 34.

Lane Marker

Traffic safety lane markers are interchangeable yellow tubes set in a separate, heavy 10" square molded base. The tubes are made in heights from 12" to 72" in increments of 12" and have excellent visibility, particularly in the tall sizes. The colors are molded in for permanency, cannot wear or flake off, and the units have good impact resistance. The markers occupy little space, are easily carried in car trunks by highway crews, and by police for use at the scene of accidents, road construction.

Stokes Molded Products, Trenton, N. J.

Circle **No. 10-25** on the convenient reply card facing page 34.

Backhoe

The Earthripper 5000, a full hydraulic operation backhoe with ½ cu. yard capacity and a 15½ ft. digging depth, has 180° action at the digging bucket and the bucket is quickly changed from backhoe to shovel operation. Digging, shoveling, or backfilling buckets are available in various sizes. High mobility is provided by the ruggedly constructed carrier with a 6 x 4 rating of 33,500 lbs. gvw or a 6 x 6 rating of 35,000 lbs. gvw. It can travel any place a truck can travel.

Cabot Corp., Machinery Div., Box 1101, Pampa, Texas.

Circle **No. 10-26** on the convenient reply card facing page 34.

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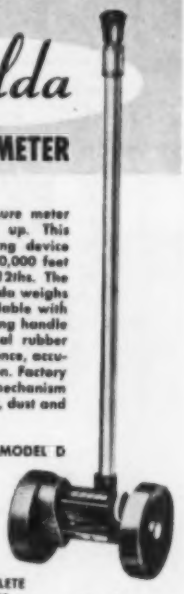
MEASURE METER

Only the Shalda measure meter subtracts by backing up. This direct-reading measuring device records accurately to 10,000 feet in feet and 10ths or 12ths. The one-man-operated Shalda weighs only 3 lbs. and is available with either solid or telescoping handle for easier storage. Dual rubber wheels for control, balance, accuracy and sure grip action. Factory sealed and lubricated mechanism is protected against dirt, dust and moisture.



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J. W. Whisman
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City of Knoxville
P. O. Box 33
Knoxville, Tenn.

Water and Gas Distribution

The City of Hamilton, Ohio, population 73,000, is now recruiting for a Water and Gas Distribution Engineer. To qualify you must have experience in water and/or gas distribution. Applicants should be capable of professional registration in Ohio. Age 25 to 45. The position offers good pay, an excellent fringe benefit program and a definite opportunity for advancement as our present Superintendent of Water and Gas Distribution is nearing retirement age.

Send brief resume, at once to:

Harold A. Hart
Civil Service Director
City of Hamilton, Ohio

Director of Public Works

A Director of Public Works and City Engineer is wanted by the City of Westminster, Colorado, a suburb of Denver. 14,000 population. Supervise 20 employees in street, water supply and maintenance, vehicle and equipment maintenance, engineering and traffic engineering activities. Desire graduate civil engineer with municipal experience, especially in traffic engineering. Salary $6,000 to $7,500.

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DIVISION OF
THE DOW CHEMICAL COMPANY
20575 Center Ridge Road
Cleveland 16, Ohio

FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"Arteries of a Nation." The manufacture and uses of pipe. (17 min., color, sound, 16 mm.) Republic Steel Corp., 1436 Republic Bldg., Cleveland, Ohio.

"The Submersible Motor Report." Gives information on electric motors which operate in the waters of a deep well. (20 min., color, 16 mm.) U. S. Electrical Motors, Inc., Box 2058 Terminal Annex, Los Angeles 54, California.

"ABS Semi-Rigid Plastic Pipe." On-location scenes demonstrate advantages offered by the plastic pipe in various installations. (20 min., color, 16 mm.) Marbon Chemical Division, Borg-Warner Corporation, Washington, West Virginia.

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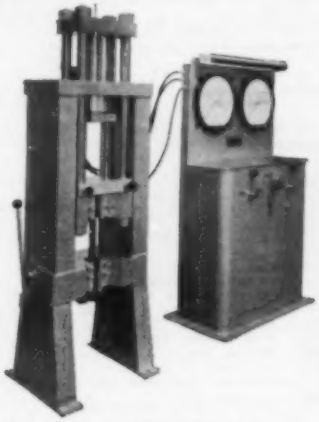

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"Operation Streetsweep." Pictures DuPont's sweeping-efficiency tests which have led to the development of broomfilling materials such as the Herox I-beam nylon filament. (15 min., sound, 16 mm.) Polychemicals Department, DuPont Building, Wilmington 98, Delaware.

"Paving the Way to Progress." Based on the theme that all development has surveying as a foundation with scenes of surveying operations on an airstrip, a town survey and other surveys. (35 min., color, sound, 16 mm.) Wild Heerbrugg Instruments, Inc., Port Washington, Long Island, New York.

"Progress in Mowing." Shows latest Terrain King 15 ft. flexible mower designs and demonstrates their cutting ability in many applications. (24 min., color, sound) SMC Mowal Division, Engler Manufacturing Corp., 4408 Center, Houston, Texas.

"Air, Water and Industry." Industrial waste problems and methods of water pollution control. (22 min., color, sound, 16 mm.) Public Relations Department Film Section, Dow Chemical Co., Midland, Michigan.

"Factory-Built Sewage Treatment Plants." Information on the Smith & Loveless plant, starring Mike Microbe. (color, sound, 16 mm.) Smith & Loveless, Inc., Division of Union Tank Car Co., Lenexa, Kansas.

"Progress Report No. 1." A preview of the 1964-1965 World's Fair showing artists' drawings of the exhibits, grounds and major features —the first in a series of filmed reports on the New York World's Fair. (27 min., color, sound, 16 mm.) Association Films, Broad at Elm St., Ridgefield, New Jersey.

"Successful Street Paving." Shows how concrete city streets with integral curbs can be constructed economically with only a minimum of equipment and personnel needed. (13 min., color, sound, 16 mm.) Local district office of Portland Cement Association, 33 West Grand Avenue, Chicago 10, Illinois.

"Consolidation of Concrete." Shows a series of laboratory and field experiments and actual jobs illustrating the effects of the admixture, Plastiment. (28 min.) Sika Chemical Corp., Attn. Advertising Manager, 35 Gregory Avenue, P. O. Box 899, Passaic, New Jersey.

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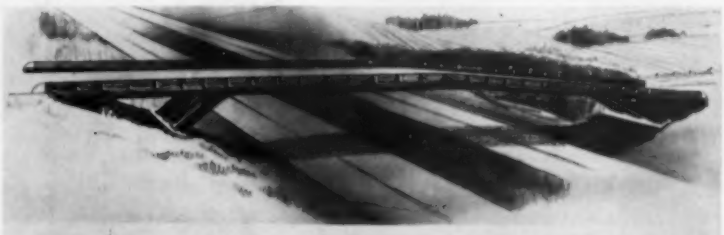
WORTH SEEING

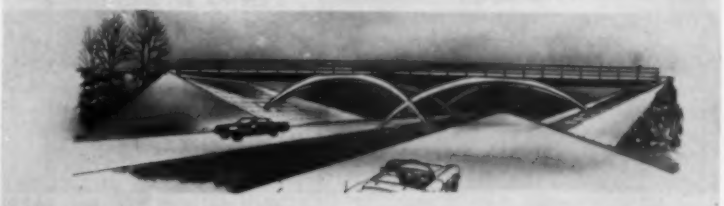
Handling backfill following a repair job on a water main, this Hough Model H-50 "Payloader" tractor-shovel owned by the Water Division of the City of St. Louis, Missouri, demonstrates one of its many applications. Unit is equipped with a multi-purpose Drott 4-in-1 bucket.

This new well drilled for Vernon, Calif., has a potential output of 2 mgd and is believed to have tapped an aquifer not previously used for water supply. The city operates 10 other wells.

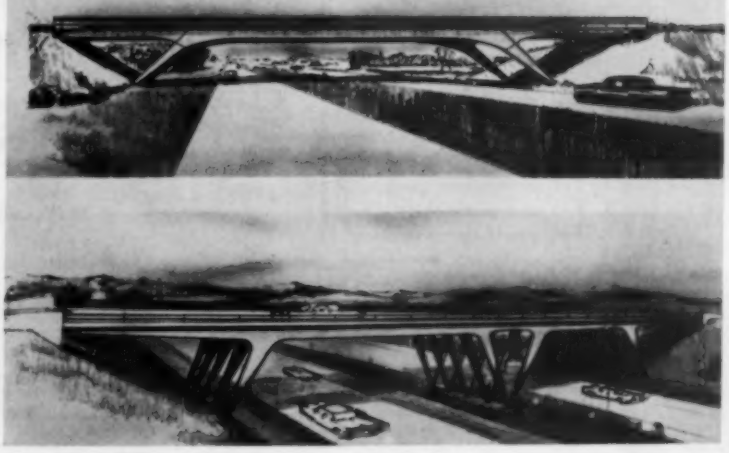
Representative designs from American Bridge Division's new idea booklet offer a glimpse into the future. Top picture shows use of a prestressed, three-span, continuous welded plate girder with structural members of USS "T-1" steel.



300 entries were submitted in contest sponsored by U. S. Steel Company. This contribution from Denmark, one of 36 in the booklet, uses a two-span flared arch with orthotropic floor.



A welded strut-framed bridge using a light formed steel floor and box section curbs to reduce weight, submitted by a designer from Switzerland.



This continuous split-beam structure with a "V" center support, inclined end supports and I-Beam-Lok floor, permits extensive duplication of parts. The idea booklet is available from American Bridge Division, 525 William Penn Pl., Pittsburgh, Pa.

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SAN GABRIEL, CALIFORNIA

by Arthur K. Akers

★ **Edward E. Alt,** generally known as "Mr. Water Tower" in the water supply field, retired to a consulting capacity with Chicago Bridge & Iron Co. after 43 years.

★ R. D. Wood Co., manufacturers of cast iron pipe, valves and hydrants, has moved its general offices from Philadelphia to their plant at Florence, N. J. **Fred W. Stakelbeck** succeeds **Warren A. Brown** there as president.

★ **Russell B. Miller** is appointed general sales manager, Chicago Pneumatic Tool Co., at New York.

★ **David R. Crandall** appointed director of truck marketing, Dodge trucks.

★ American Concrete Corp. will move its offices and manufacturing facilities to Waukegan, Ill. Product in the public works field is concrete lighting standards.

★ Keasbey & Mattison Co. names **Philip J. Hughes** district sales manager at Los Angeles.

★ **E. J. Goes,** widely known in the highway equipment field, formerly advertising manager of the Koehring Co., joins Maercklein Advertising, Inc., Milwaukee. His duties will include serving as new business director in the construction equipment field.

★ **S. Bruce Humphrey,** director of marketing of Carus Chemical Co., LaSalle, Ill., elected to the company's board of directors.

★ Lock Joint Pipe Co. appoints **Russell G. Stair** assistant manager, Plastics Div., Wharton, N.J., producing PVC pipe, valves and fittings as well as corrosion resistant coatings and linings.

★ Tinker & Rasor, San Gabriel, Calif., have acquired the Detectron Co. from Computer Measurements Co. Operations have moved from Sylmar to San Gabriel, where the full line of holiday, leak and pipe detectors will continue to be produced.

★ The Westinghouse Air Brake Co. has begun moving its Le Roi Division to Sidney, Ohio; the removal to be completed by Spring, 1962.

★ **Donald W. Waack** becomes manager of Sales Promotion at Bucyrus-Erie Co., South Milwaukee, Wis. He had been assistant sales development manager, Schield Bantam Co.

Mr. Waack

Mr. Koch

★ **Edward C. Koch** appointed vice-president, Orangeburg Mfg. Co. Division of The Flintkote Co., New York. He will be in charge of asbestos-cement pipe sales of the output of the new $10 million Ravenna, Ohio, plant of this Division. He was formerly with Johns-Manville Corp.

★ FWD Corp., Clintonville, Wis., names **Gary W. Backes** manager of its Highway Market Department.

★ **Kenneth R. Daniel** elected executive vice-president, American Cast Iron Pipe Co., Birmingham, filling the vacancy created by retirement last year of **Arnold Herrmann.**

★ **Lloyd G. ("Gary") Byrd,** associate editor of PUBLIC WORKS on highway matters, named secretary to the new Committee created by the ASCE on Construction, Maintenance and Operation of Highways. **John E. Wiley** of the ARBA will be chairman of it.

★ **W. H. Schomburg, Jr.,** promoted to general sales manager, Dana Corporation, manufacturers of truck and car components, Toledo, Ohio.

★ The fellow who thinks he knows it all is especially annoying to those of us who do.

—Wisty Farrell

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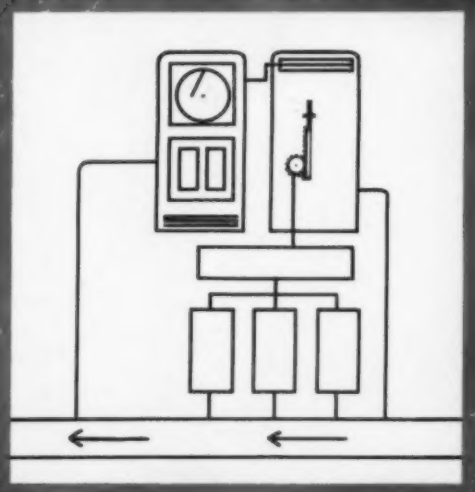

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